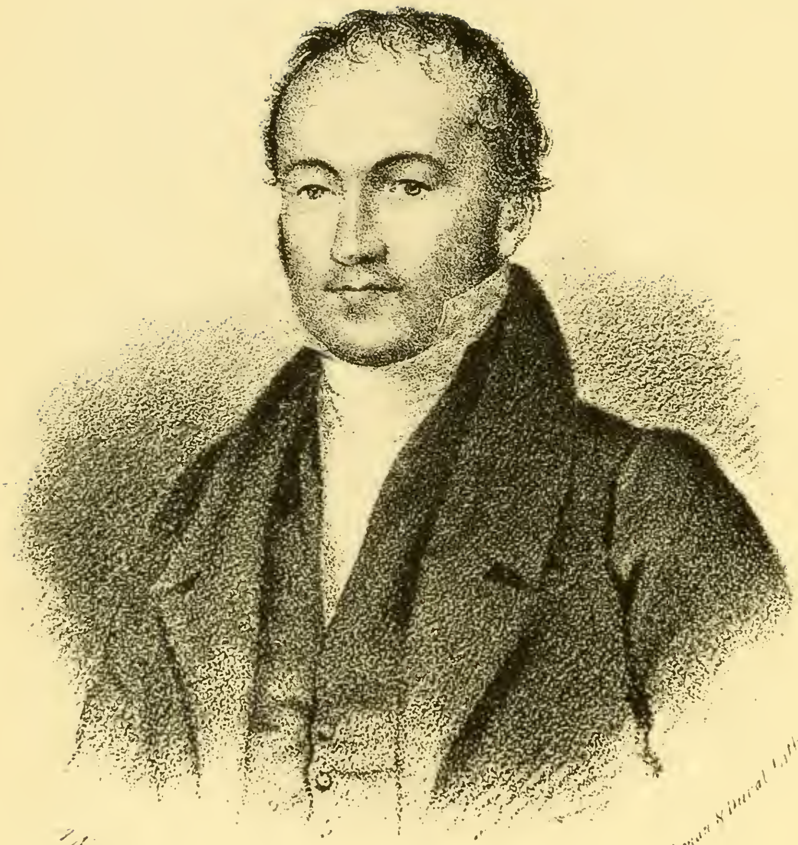

Lehman & Duval Lithrs

Lewis David von Schweinitz.

JOURNAL

OF THE

Elisha Mitchell Scientific Society,

1885--1886.

THIRD YEAR.

PUBLICATION COMMITTEE:

R. H. GRAVES,
J. A. HOLMES,
GEO. F. ATKINSON.

SECRETARY:

F. P. VENABLE, CHAPEL HILL, N. C.

RALEIGH:
EDWARDS, BROUGHTON & CO., POWER PRINTERS AND BINDERS.
1886.

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1885--1886.

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G. F. ATKINSON, B. Ph.

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JOURNAL

OF THE

ELISHA MITCHELL SCIENTIFIC SOCIETY.

REPORT OF THE RESIDENT VICE-PRESIDENT FOR THE YEAR 1885-'86.

J. W. GORE.

A brief review of the work of the Mitchell Society, for the year 1885-'86, will, it is hoped, give fresh encouragement to those who have taken an active part in its upbuilding, and help to gain the confidence and support of all interested in scientific work in our State; and also of others who may be willing to lend us a helping hand. But, if the Society has not advanced as rapidly as some may have expected, then this review may serve as a stimulus to greater endeavor during the coming year, urging them to help make of the Society the agent in the progress of science that we hope and expect it to become.

Regular monthly meetings have been held for hearing papers and discussing scientific questions of interest.

These meetings were limited to members and invited guests as last year, and were always attended with interest and profit. While the attendance was usually good, yet the interest taken in the meetings by the students of the University has not been as great as we had hoped. It is a rare opportunity for them to begin taking an active part in such work as the Society encourages. While learning what others have done, it is of great importance to practice their method and acquire the habit of independent investigation. Scientific workers are essential to the development of the wealth of the State, and

if our young men are not trained for the work it must be done by others.

The public lecture feature of our Society developed, the present year, into the University Lecture Course, consisting of a series of public lectures throughout the session.

It is very gratifying to be able to state that this has been the most prosperous year of the Society. Sixty-one papers have been read and presented. Those of a technical character will appear in the Journal, together with a few of those of more general interest.

Our Society is now recognized by several other similar organizations, and publications exchanged. Commendatory notices, as well as the republication of papers in other Journals, are reasons for congratulation and renewing of effort. Another source of encouragement is the growing demand for our Journal by workers in science; and the frequent testimonials we receive of its usefulness to them.

Our President during the past year rendered valuable service in other ways than by contributing to the profit and interest of our meetings. His kind and timely words of cheer and counsel have been a source of pleasure and profit, and we rejoice anew that he will stand at the helm another year.

With the hope that has been inspired by the measure of success already attained, the increase in the resident working force and the fairer prospects of the coming year, we trust that every one interested in the prosperity of the Society and the cultivation of the spirit of science in our midst will enter upon the work of another year with renewed courage and continue with unabated interest.

The present number of the Journal contains a portrait and sketch of the life of Dr. L. D. Von Schweinitz, and we hope to be able to give a portrait and biography of Prof. W. C. Kerr in the next.

REPORT OF THE SECRETARY.

F. P. VENABLE.

BUSINESS MEETINGS.

AUGUST 26, 1885.

Prof. J. W. Gore presided. A quorum of the Council was present.

The Secretary read letters of acceptance from the officers and honorary members elected at the last meeting. The death of the late President, Dr. W. C. Kerr, was announced to the Society, and a committee consisting of the Secretary and Dr. Charles Phillips was appointed to draw up resolutions expressive of the grief of the Society at the loss it had sustained. These resolutions were ordered to be published in the Journal for 1884-'1885, and to be transmitted to the family. It was resolved that a list of donors to the Library be published and an appeal for further contributions be made.

On motion, the system of public lectures was placed in the hands of the Faculty of the University of North Carolina, and was no longer to be regarded as belonging distinctively to the Society's work.

The Executive Committee was instructed to make arrangements for regular meetings on the third Saturday of each month, beginning with September and omitting December and May.

Prof. Atkinson was elected to fill the vacancy on the Executive Committee.

MAY 15th, 1886.

Prof. J. W. Gore in the chair. The reports of the retiring President and Secretary were read.

The following officers were elected for the ensuing year:

President, Dr. Thos. F. Wood; Vice-President, Prof. J. A. Holmes; Secretary and Treasurer, Dr. F. P. Venable. Executive Committee, Prof. J. W. Gore, Dr. W. B. Phillips, Prof. J. L. Love.

On balloting for honorary members the following were elected:

Dr. H. W. Ravenel, Aiken, S. C.; Prof. W. K. Brooks, Johns Hopkins University; Prof. W. M. Fontaine, University of Virginia.

Prof. A. M. Elliott, of Johns Hopkins University, was elected a life member.

The following regular members were elected during the year:

PROF. W. L. POTEAT,	Wake Forest College, N. C.
ARTHUR WINSLOW, ESQ.,	Raleigh, N. C.
PROF. WM. CAIN,	Charleston, S. C.
PROF. W. D. TOY,	University of North Carolina.
PROF. NELSON B. HENRY,	University of North Carolina.
DR. THOMAS HUME,	University of North Carolina.
GERALD MCCARTHY,	Washington, D. C.

PUBLIC MEETINGS.

NATURAL HISTORY LECTURE ROOM,
SEPTEMBER 19th, 1885.

1. North Carolina Triassic, ... J. A. HOLMES.
2. Analysis of Water from Durham Artesian Well, ... F. P. VENABLE.
3. Longevity of Frogs, ... J. A. HOLMES.
4. Some New Explosives, ... F. P. VENABLE.

October 17*th*, 1885.

5. Report on the Meetings of Science Associations, ... J. W. GORE.
6. The New Star in the Nebula of Andromeda, ... R. H. GRAVES.
7. Peach Tree Boring Beetle, ... GEO. F. ATKINSON.
8. History of the Last Century of Mathematics, ... J. L. LOVE.
9. Apparatus for Filtering, ... H. B. BATTLE.
10. A Thermometer for Class Illustration, ... F. P. VENABLE.

November 25*th*, 1885.

11. Progress in Meteorology and Engineering, ... J. W. GORE.
12. Sketch of Dr. N. M. Hentz, ... GEO. F. ATKINSON.
13. The Condition of the N. C. Indians, ... J. A. HOLMES.
14. Theories Deduced from the Occurrence of the Elements, ... F. P. VENABLE.
15. Trap-Door Spiders, ... GEO. F. ATKINSON.
16. Note on the Folding of Rocks, ... J. A. HOLMES.

17. Comparison between the Washington and Atlanta Methods for Estimating Reverted Phosphoric Acid, ...H. B. BATTLE.
18. Note on the Loss of Moisture in Bottled Samples,........H. B. BATTLE.

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19. Chinook or Foehn Winds and Festoon Clouds,.............J. W. GORE.
20. Occurrence of the Diamond in North Carolina, ...F. P. VENABLE.
21. Further Observations on the Trap-Door Spider, ...G. F. ATKINSON.
22. History of the Geological Surveys of North Carolina, ...J. A. HOLMES.
23. Variations in Thermometrical Observations,.............F. P. VENABLE.
24. Effect of Pressure on Thermometers,...F. P. VENABLE and J. W. GORE.
25. Propionyl-anhydro-iso-di-amido-toluol, ...J. M. PICKEL.
26. Solubility of Alumina in Sulphuric Acid, ...R. GRISSOM.

February 17th, 1886.

27. Biographical Sketch of Dr. L. D. Von Schweinitz, ...
28. The Cigarette Beetle,............................ G. F. ATKINSON.
29. Work of Dr. Emmons in connection with the N. C. Geological Survey.......................................J. A. HOLMES.
30. Water as a Factor in Chemical Reactions,..............F. P. VENABLE.
31. Note on the Decomposition of Potassium Cyanide, ...I. H. MANNING.

March 17th, 1886.

32. Uses of Electricity in Warfare,............................J. W. GORE.
33. Tidal Friction, ...R. H. GRAVES.
34. The Coast Line at Cape Hatteras,...................... J. A. HOLMES.
35. Fire-Extinguishing Grenades,.........................F. P. VENABLE.
36. The Development of Mathematics, ...J. L. LOVE.
37. A Nest of Ants with Domesticated Animals,..........G. F. ATKINSON.
38. Meteorology of Chapel Hill for 1885,...................F. P. VENABLE.
39. Note on the Freezing of Standard Solutions, ...F. B. DANCY.
40. Analysis of Lithographic Stone, ...J. L. HOWE.
41. Sugar Beet Culture in Kentucky,.........................J. L. HOWE.
42. Some New Salts of Camphoric Acid,..................I. H. MANNING.
43. Comparative Analysis of N. C. and Tenn. Coals,.........H. B. BATTLE.
44. Chemical Examination of N. C. Species of Genus Ilex,..F. P. VENABLE.

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45. The New Element Germanium,.........................W. B. PHILLIPS.
46. Directions for Arranging a Natural History Cabinet, ...G. F. ATKINSON.
47. Use of Thomas' Slag as a Fertilizer, ...W. B. PHILLIPS.
48. Neutrality of Ammonium Citrate for Determining Reverted Phosphoric Acid, ...H. B. BATTLE.

May 19th, 1886.

49. Caldwell County Antiquities, ... J. M. SPAINHOUR.
50. Effect of using Different Amounts of Phosphate in Determining Soluble Phosphoric Acid, ... H. B. BATTLE.
51. Reversion of Soluble Phosphoric Acid, ... H. B. BATTLE.
52. Effect of Finer Pulverization of Fertilizer Samples .... H. B. BATTLE.
53. Determination of Moisture in Fertilizer Samples, ... H. B. BATTLE.
54. Action of Albumenoids on Reagents for Alkaloids, ... D. S. CARRAWAY.
55. A New Lead Salt, ... R. GRISSOM.
56. Effect of Moisture on Ignition of Hydrogen by Spongy Platinum, ... R. S. WOODSON.
57. Octyl-Benzol and its Derivations, ... E. A. VON SCHWEINITZ.
58. Triassic Sandstone in North Carolina, ... J. A. HOLMES.
59. Description and Exhibition of a Core from Diamond Drill in the Coal Region of Pennsylvania, ... J. A. HOLMES.
60. A Theory of Cyclones, ... B. F. GRADY, JR.

REPORT OF THE TREASURER.

F. P. VENABLE.

	DR.	CR.
Balance in Treasury August 1st, 1885,	$ 85 12	
Annual fees 1884–'85,	7 50	
Annual fees 1885–'86,	99 00	
Printing Journal for 1884–'85,		$ 138 15
Engravings,		24 50
Express charges,		4 80
Postage,		7 55
Sales of Journals,	54 95	
Special contributions,	16 00	
Balance,		87 57
	$ 262 57	$ 262 57

Balance in Treasury October 1st, 1886, ... $ 87 57

A SKETCH OF THE LIFE AND SCIENTIFIC WORK OF LEWIS DAVID VON SCHWEINITZ.

LEWIS DAVID VON SCHWEINITZ was born at Bethlehem, Northampton County, Pennsylvania, on the thirteenth of February, 1780. His father, Hans Christian Alexander von Schweinitz was of an ancient and distinguished family in Silesia, in Germany, and exercised here the functions of Superintendent of the fiscal and secular concerns of the "*Unitas Fratrum*" or Moravian Brethren in North America. His mother was Dorothea Elizabeth de Watteville, daughter of Baron, afterwards Bishop, John de Watteville, and of Benija, who was a daughter of Count Zinzendorf. Of the last mentioned ancestor, it may not, for reasons which will appear in the sequel, be inappropriate to make a passing reminiscence.

Nicholas Lewis, Count Zinzendorf, was born at Dresden, in 1700, and was celebrated in his youth for forming religious societies, six or seven of which are said to have originated from his own efforts, and one at least to have been planned at the early age of ten years.

He was associated with Watteville in founding the great missionary system of the "*Unitas Fratrum*." At the age of twenty-one he became Count of Berthelsdorf, in Lusatia, by purchasing the estate appendant to that title, and soon after established there the village of Herrnhut, whence the Moravians are sometimes called *Herrnhutters*. In prosecution of his favorite scheme, he, in connexion with his new colony, many of whom were natives of Moravia, commenced the sending of missionaries to instruct the heathen, and at the end of nine years, though their numbers did not when they first made the attempt exceed 600, had actually formed establishments in Greenland, St. Thomas, St. Croix, Surinam, Rio de Berbice, among the Indians of North America, and the Negroes of Carolina, in Lapland, Tartary, Algiers, Guinea, in the Island of Ceylon, and at the Cape of Good Hope. In his ardour for attain-

NOTE.—This sketch is compiled from the memoir of von Schweinitz, by Walter R. Johnson, read before the Academy of Natural Sciences of Philadelphia in 1835, and published by the Academy, and from facts contributed by his son, Bishop Edmund de Schweinitz. The above mentioned memoir has, as a rule, been closely followed, and often exactly reproduced. The portrait of Dr. von Schweinitz, placed as frontispiece to this Journal, was presented by his family. EDITOR.

ing his favorite object, Zinzendorf made various journeys through Germany, Denmark, Switzerland, Holland, England and America. In 1742 he held frequent religious discourses at Germantown, in the vicinity of Philadelphia, and in the same year, in a Latin speech delivered in Philadelphia, formally renounced his title of Count, resumed his original family name of von Thumsteen and became familiarly known to the Quakers of that period under the designation of "friend Lewis."

It was under his immediate agency that the colony at Bethlehem was founded. He did not, however, attain all his successes without undergoing, both in Europe and America, several bitter persecutions, but these probably served as usual only to bind his followers in a firmer union, and more effectually to insure their prosperity. After having established his plan in all the four quarters of the globe, and sent out about 1,000 individuals to proclaim his doctrines, he finally died at Herrnhut in 1760, where, we are informed, his obsequies were attended by 2,000 of his followers, and his body borne to the grave by 33 of those messengers of his faith who were at the time assembled there from Holland, England, Ireland, Greenland and North America.

The contemplation of his example, a man who was at once the ancestor of his family and the father of his denomination, with that of other distinguished progenitors, early impressed the imagination of the youthful Schweinitz with an ambition for a career of similar activity, and gave the first impulse towards the acquisition of literary and scientific eminence.

The society of those friends with whom the early years of his childhood were spent was calculated to inspire him with the same affections and views which had operated on his ancestors for two generations. His mind was here imbued with those principles which, at a later period, shone forth in the purity and simplicity of his manly character.

Endowed with powers of conception of no ordinary cast, he gave early indications of his bias for intellectual pursuits, and by his assiduity more than compensated for any deficiency in the means of improvement then within his reach. The clear and explicit manner in which his juvenile ideas were expressed, encouraged his fond parents to indulge the hope that he would one day become an active instrument in advancing the cause to which themselves and their predecessors had been so assiduously devoted. Being the eldest son of his parents, and at that period of delicate constitution, it is reasonable to suppose that maternal influences had much to do in

the development of his faculties. It was, moreover, on the side of his mother that he was related to Watteville and Zinzendorf, hence, we may readily suppose that from this source he derived his partiality for addressing to his friends short speeches and little sermons with which he is said occasionally to have amused the circle around his paternal fireside.

We are aware that, in general, anticipations founded on an exhibition of precocious talents are apt to be signally disappointed, but when the display is that of an intellectual *tendency*, rather than a mere capacity for some one attainment, and when the *spirit* for mental labour is found capable of being directed into different channels at the instance of others, and does not consist of a blind instinct compelling the possessor to follow some narrow path of intellectual effort, the augury may, we apprehend, be received with less doubt and uncertainty. Such was the case with Schweinitz. His mind was vigorous and his temperament enthusiastic. The *first* direction of these qualities was given by his relatives as they dwelt on the unwearied and successful exertions of his ancestors among the fraternity, in promoting whose interests he was taught to feel that it would be most honorable to excel ; the *second* was subsequently given by his teachers, when, by the casual exhibition and explanation of some specimens of natural history, they struck a vein of talent, part of the same rich mind which had only here and there "cropped out" above the surface.

On the 4th of July, 1787, at the age of little more than seven years, young Lewis David was placed in the institution of the Moravian community, at Nazareth, where he continued for eleven years or until 1798, and where he sedulously availed himself of every opportunity for the acquisition of knowledge. The period of instruction—as generally happens when parental precepts and example have prepared the way for a relish of knowledge—was to him a season of delight, a scene of his life to which he ever after reverted with peculiar pleasure. Here were formed those habits of practical wisdom, which, when subsequently methodized in the schools of Germany, produced that happy balance of the faculties without which the most brilliant talents may be wasted, either on ill-directed efforts or on wild and fanciful theories. His powers of language, and his vein of satirical humour, were at this time occasionally put forth in the form of poetical effusions, turning the fruits of his leisure hours into harmless amusement for his companions.

The apparent faculty with which he afterwards composed in the Latin language, induces the belief that his early classical instruc-

tion was of a very respectable order, and certain it is that the qualities of his heart were not neglected; his moral character was built on the broad and liberal basis of justice, love and charity, so distinctly inculcated in the doctrines of his community.

In the baneful spirit of uncharitableness, he saw nothing either lovely or respectable; it never found a lodging in his heart, and he had accordingly no occasion in after life to eject so unprofitable a tenant.

His first impulse towards the study of botany had been received at Nazareth, before being placed as a pupil in the institution. When a mere child, being on a visit to that place with his grandfather, Bishop de Watteville, it chanced that a specimen of the *Lichen digitatus*, lying on a table in one of the apartments of the school, attracted his attention and led to a few observations on its name and physiology. From this moment he dated his partiality for the beauties of the vegetable kingdom. When his abode was afterwards fixed at the school and he enjoyed the advantage of some instruction in the elements of botany from one of the teachers in the seminary, he pursued his researches in this delightful science with the most enthusiastic ardor. He seems to have been, in truth, a very child of Flora, and with the vernal breath of that divinity, to have inhaled all the benign influences which the beauty, simplicity and grandeur of *nature's truth* are everywhere fitted to inspire.

A partial flora of Nazareth and its vicinity, formed at this early period, is still among his manuscript papers, and the occupation which its composition afforded to his moments of relaxation continued through life to constitute the delight of his leisure hours. Such were his attainments that before the close of his connection with the Nazareth institution, young von Schweinitz was appointed to participate in the duties of instruction by taking charge of some of the junior classes in that Seminary.

In 1798 his father was called to Germany whither he was attended by his family, and where the subject of this memoir, then a youth of eighteen, was in the same year established as a student in the theological institution in Niesky, in upper Lusatia. Here enjoying an intercourse with young men of decided and acknowledged talent, and entering on studies which excited a generous emulation, his faculties were roused to redoubled energy and his application became proportionately intense. The late excellent J. B. de Albertini, then one of the professors in the institution, exercised a powerful influence over the mind of von Schweinitz, and to the clearness and simplicity of his views, his scientific and truly philosophical ideas, was

the subject of this sketch indebted for much of that greatness of thought and firmness of principle which carried him with success through the active duties of life. The mutual esteem thus formed between the pupil and his teacher was afterwards by similarity of pursuits and predilections, matured into the closest intimacy. While prosecuting his studies in this place von Schweinitz enjoyed, by means of his extensive connexions, an opportunity of mingling much in society, of which his cheerful and sprightly conversation rendered him the common centre of attraction. But neither in this situation nor in his subsequent foreign journeys did his feelings ever swerve from an attachment to his country; and yet it is not from him that any modern traveller has learned the practice of vilifying every country through which he passes, much less, on returning home, that of bestowing on his *own*, by way of reparation, a double store of the same abuse.

After completing his theological studies von Schweinitz engaged as a teacher in the Academy at Niesky, and by this means, enlarging and strengthening his own acquisitions, realized the truth of the maxim, *docendo discimus*.

The presence of several valued friends engaged in the same pursuits, the cultivation of his favorite department of botany, a connection with his cherished associates, Professor Albertini and Henry Steinhauer, (from England), and the opportunity of improving his taste for literature by various reading and frequent composition on the prominent subjects discussed in literary journals of the day, all contributed to his improvement and rendered the arduous duties of his station a pleasure rather than a burden. Scarcely any important topic in the wide field of science escaped his notice, and especially did the constitution and management of the affairs of his social and religious fraternity call forth from his pen many able and spirited articles.

From the commencement of his residence at this place his botanical researches had been particularly directed to the *Fungi*, a department previously much neglected, and in 1805 the number of new genera and species discovered by himself and Albertini was so great as to warrant the publication of a volume of about four hundred pages, containing the result of their united efforts. As we shall again recur to this, in connection with his other established works, it will not be necessary here to interrupt our remarks to present its peculiar merits as a scientific production.

Near the close of his residence at Niesky, he began to exercise the functions of a preacher, and was, in 1807, called to the Moravian

settlement at Gnadenburg, in Silesia, where his acquisitions were turned to good account in various ways connected with his profession. Besides parochial duties he again discharged the office of teacher in bringing forward many of the young men of his community who were preparing for the duties of his own calling. Upon his character as a preacher there is the less necessity that we should comment, even were this the place and were we competent to such an undertaking, because, in that capacity, his brethren have already exhibited to the public a view of his meritorious labour. We would merely state that, considered as literary performances, his sermons were characterized by the utmost simplicity, both in style and delivery, and were addressed more to the heart than to the head. His discourses were invariably practical, not argumentative—experimental, not speculative.

The period of which we are speaking, it will be recollected, was that of Bonaparte's continental wars, and Germany the scene of his operations. Von Schweinitz was, therefore, with his peaceful flock, brought into immediate proximity to the actors in those tremendous conflicts. But, though troops were quartered in Gnadenburg, his happy disposition and winning deportment gave him such ascendency over all ranks as to avoid causes of collision, and to render him a general favorite with strangers.

In 1808 von Schweinitz was invited to Gnadau, in Saxony, where in the discharge of duties similar to those at Gnadenburg, and with equally distinguished success, he continued to be engaged until 1812, when he was appointed by his brethren general agent of their church in the Southern States of this Union. Previously to repairing to the scene of his duties he formed a matrimonial alliance, at Niesky, with Louisa Amelia le Doux, whose parents, descendants from highly respectable French ancestors, resided at Stettin, in Prussian Pomerania. The continental system of Napoleon at that time rendering direct communications with this country extremely hazardous, they were compelled, in order to embark for the United States, to take the route through Denmark and Sweden. This circumstance was not wholly without its advantage; for on arriving at Kiel, in Holstein, an occasion presented itself for a protracted stay, during which von Schweinitz became acquainted with several learned men connected with the University in that place, and the mutual satisfaction was such as to induce the institution during the same year to confer on him the honorary degree of Doctor of Philosophy.

About the period of their final embarkation the United States had declared war against Great Britain; the seas swarmed with priva-

teers, and to try their firmness still more severely, a tempestuous voyage ensued, terminating in a tremendous storm, by which their vessel was dismasted and a horrible suspense for a time hung over their destiny.

A journal kept on this voyage manifests, however, the fervent and patriotic feeling which cheered the heart and buoyed up the hopes of von Schweinitz in the near prospect of extensive usefulness in the land of his nativity.

The immediate scene of his duties was the establishment at Salem, Stokes County, North Carolina, where he found time to prosecute the study of botany in a dominion, scientifically speaking, all his own. His stay in North Carolina embraced a period of ten years, from 1812 to 1822. Although not a native he had a strong predilection for this State, having often heard his father and grand-father speak of their visits to its early settlements, and when he became a resident he enjoyed thoroughly the life which it opened to him. His official duties were very arduous. He was a member of the Governing Board of the Moravian churches in North Carolina; a trustee of the Salem Female Academy; the administrator of the very large landed estates which the Moravian church owned in that State and which were originally purchased of Lord Granville in 1753, and at the same time he frequently preached the gospel at Salem and other places.

In the midst of these duties, however, he always found time for his scientific researches. Hardly a day passed by on which he did not go out on botanical excursions in the vicinity of Salem. He extended these excursions at times as far as Raleigh. Stokes and Surry Counties he thoroughly explored. On one of these tours he discovered, among the Sameton Mountains in Stokes County, a most beautiful waterfall which for many years bore his name. Among his scientific correspondents during this period were Dr. Reichenbach, of Dresden; Kunze, of Leipzic; Le Conte, U. S. A.; Blumenbach, of Gottingen; Elliot, of South Corolina; Schwaegrichen, of Leipsic; Hooker, of England, &c.

It was during this period also that the Presidency of the University of North Carolina was tendered Dr. von Schweinitz. As the acceptance of this honor would have necessitated his relinquishing his service in the Moravian church he declined it. He believed he had been called of God to engage in this service. All the traditions of his family up to his ancestor, Count Zinzendorf, were instinct with loyalty to that church and its work.

The first fruits of his labor were given to the world in 1818,

through the commentaries of the Society of Naturalists at Leipsic, under the editorial care of his learned friend Dr. D. F. Schwaegrichen, and under the title "Synopsis Fungorum Carolinæ Superioris." In the same year his duties required him to attend a meeting of his religious brethren at Herrnhut. On his way thither he visited England, France and Holland, where he established correspondences which were afterwards of great service, when, on his return, he began the formation of a regular herbarium.

In 1821, Dr. Schweinitz published at Raleigh, N. C., a pamphlet containing a description of seventy-eight species of *Hepatic Mosses*. This he produced as a mere specimen of the cryptogamic flora of North America, intended to excite a more general attention among our native botanists to this undeservedly neglected branch of natural history. In the same year he sent to Professor Silliman's Journal his monography of the genus Viola, a valuable paper, often cited by European naturalists.

At the close of this year his residence was transferred to his native village, Bethlehem, where the secular office of general agent for his brethren was retained, the charge of superintending the institution for the education of females accepted, and the study of his darling science unremittingly pursued. To range once more in the vigor of his scientific maturity over the same scenes in which had been sown the seeds of his usefulness, and where had budded the promises of his early youth, imparted new energy and assiduity to his efforts. The beautiful slopes and valleys about Bethlehem and Nazareth, the romantic banks of the Delaware, and the precipitous rocks of the Lehigh, all yielded up to him a tribute of their hitherto unexplored treasures. The high estimation set upon his works by men of science had procured his election as an honorary member in several societies devoted to natural history, both in Europe and America. His correspondence increased and the formation of his herbarium advanced with great rapidity.

In 1823 he was desired to examine and describe the plants collected by Mr. Say, on the expedition of Major Long to the sources of the St. Peter's river. This task he undertook with that diffidence which signalized his real merit, expressing his regret that the unavoidable absence of Mr. Nuttall from the country should have prevented *him* from executing this undertaking, agreeably to previous arrangement, and passing on that gentleman a high and delicate eulogium.

Near the close of the same year he also communicated to the Lyceum of Natural History, at New York, a valuable paper contain-

ing instructions for determining the American species of the genus *Carex*, a work which, though less imposing in appearance, must doubtless have cost more intense application and more exact powers of discriminating between specific characters than would have sufficed for the description of many new species of plants.

In 1824, Dr. von Schweinitz communicated to the American Journal of Science a short paper on the rarer plants of Easton, Pa., almost all of which, he remarks, are principally met with on shady rocks up the Delaware or at the mouth of the Lehigh.

In the same year appeared his Monograph of North American Carices. Being about to embark a third time for Europe this paper, together with a large collection of the specimens from which it had been prepared, was placed in the hands of his friend, Dr. Torrey, with a desire that it might be communicated to the Lyceum of Natural History, and giving him full liberty to use his discretion in the additions or alterations which it might, from subsequent discoveries of his own, seem to demand. Finding on his return that his editor had made important additions to the number of species, the honorable mind of Dr. von Schweinitz led him to request that it should appear as their joint production; remarking, that "the judicious and elaborate amendments he has proposed, and the mass of new and valuable matter he has added, entitle Dr. Torrey to a participation in the authorship of the work." This incident is mentioned only as indicative of the feelings and dispositions of the man.

The voyage undertaken this year was with a purpose similar to that of 1818, and on both occasions he exercised on the deliberations of his brethren at Herrnhut a decided and salutary influence.

During his absence from the country his paper on the new American Species of Spheriæ, one of the largest genera among the Fungi, was communicated to the Philadelphia Academy and appeared in the fifth volume of the Journal.

On his return, near the close of the year, his pursuits, except the superintendence of the literary institution, which he had previously relinquished, were resumed with his wonted alacrity. The great work to which he now devoted his leisure was the Synopsis of North American Fungi, which was originally designed for publication in some of the European journals, but which he was induced to present, in 1831, for insertion among the collections of the Philosophical Society of Philadelphia.

Until the year 1830, the health of Dr. von Schweinitz had been excellent, and his spirits uniformly cheerful, but the various and increasing cares of his official station, with the sedentary employment

of composing a dissertation on the affairs of his community, during which his usual excursions and exercise were omitted, wrought a visible change in the state of his health; a severe cough ensued, with other alarming symptoms, which gave his friends just ground for apprehension. From this time his health seemed gradually to decline. The want of his accustomed occupations in the open air also depressed his spirits, and produced a marked contrast to that buoyancy which had hitherto shed its influence on all around him.

A journey to the Western States, undertaken in connection with his official duties, appeared for a short time to revive the energies of his frame. But, though externally more active and cheerful, the deep workings of disease had undermined his system, and on the morning of the 8th of February, 1834, being awakened at an early hour by a sensation of faintness, and when relieved by medical applications, again relapsing for a short time into a state of repose, he fell, at the age of fifty-four years, calmly and unconsciously into the arms of death.

The colloquial powers of Dr. von Schweinitz were of a high order. Humor, wit, anecdote and repartee were always at his command. In the multiplied relations with society he had contracted that ease of intercourse which tends so essentially to conciliate the kind affections.

Hence, though always listened to with profound respect when in the discharge of professional duties, whether as a teacher or a clergyman, yet the sphere of his greatest usefulness was the *social* circle, and the familiar intercourse which he maintained with the people of his own persuasion. In the exchange of thought, the imparting of sympathy, and the expression of fraternal feeling, so habitually cherished by the class of society with which it was his fortune to be connected, and in the deep sense of responsibility under which he appears to have constantly acted, we find the immutable guarantees for that uprightness and the best explanation of that social influence which characterized him.

His literary attainments were those belonging to the scholar and the gentleman. He was acquainted with the Greek and spoke and wrote the English, German, French and Latin languages. Unlike most persons of German descent, he was entirely insensible to the charms of music.

Our sketch of the scientific labors of the deceased must necessarily be confined to some leading points in the general character of his more important works.

When we consider the extreme difficulty of the particular depart-

ments of botany to which Dr. von Schweinitz devoted his chief attention, the prodigious number of facts which he has accumulated, the vast amount of minute and delicate investigation demanded by the nature of the objects of his study, the labor of preparing for the press the materials which he had brought together; when we recollect that, with the exception of Dr. Muhlenburg, of Lancaster, no American botanist had ventured far upon this wide and unexplored dominion of nature; and when we remember that this science was his relaxation, not his profession, his occasional pursuit, not his daily duty, we are forcibly struck with the high order of his talents for the pursuit of science, and cannot but regret that more of his time and energies could not have been devoted to his favorite occupation.

The botanical works of Dr. von Schweinitz indicate not only great industry and perseverance in the collection of facts, but a judicious *method* in the prosecution of his labors. The synoptical tables attached to his several monographs are evidences of the importance attributed to this feature in his productions. His analytical table to facilitate the determination of the *Carices* affords another striking illustration of the benefit to be derived from a systematic pursuit of scientific studies. And since this analytical table was doubtless the result in part of his own inductive studies, it proves that of those studies he was able to make a legitimate and profitable use, by arranging all his facts under appropriate general heads, and to point out to future inquirers in what path to pursue the labors which he himself has so happily followed. His monograph of the Carices of North America, soon after published, gave proof of the utility of this methodical arrangement.

Among the most extensive and, in a scientific point of view, the most important of his labors, are those which relate to the Fungi. Four of his principal works refer to this abstruse branch of botany.

Three of them, the "Conspectus Fungorum Lusatiæ," the "Synopsis Fungorum Carolinæ Superioris," and the "Synopsis Fungorum in America Boreali Medea Degentium," are all, as their titles impart, written in the Latin Language.

It may in the next place appear singular that so great a part of his exertions should have been devoted to the cryptogamous plants. But to this preference he had, by birthright, a sort of hereditary or derivative national title, since it is to German, Danish and Swedish botanists that we owe by far the greater part of our knowledge of that difficult department.

Von Schweinitz had in his collection of Fungi fine specimens of

the *Dematium aluta*, taken out of the ships of war built by our government, on Lake Erie, where, in a few years, he remarks, "this little fungulous enemy completely destroyed that fleet which had so signally vanquished the armament of Britain." (Syn. Fungor. in Am. Bor., p. 287.)

In the synopsis of the "Fungi of Lusatia," the authors, with becoming spirit, discarded the then too frequent practice of writers in changing the names of plants and adopting new synonyms, merely, as would often appear, to compel future naturalists to cite their own names in connection with the trivial specific appellations which they choose to affix to well-known objects. This course they avoided under the conviction that natural history had received, and was daily receiving, great detriment from the accumulation and confusion of these synonyms.

They, moreover, assiduously avoided superfluous repetition of the names of classes, orders, genera, and species, and gave a true synopsis of the department which they professed to treat. They followed the steps of Persoon, sensible that though this method may be in some points defective, it is better not to depart from so able a guide, for, they remark, "it is well known how much easier it is to find fault with our neighbor's house than to build a better and more commodious one ourselves." "A solid basis to this department of botanical science," they add, must be laid not on a sandy foundation, on the varying freaks and fancies of the mind, but on a perpetual daily and nightly employment of microscopic observation, a diligent and oft repeated examination of the whole history of the fungus tribes, a careful perusal of authors, a comparison of their respective synonyms, and above all by the observation of living nature herself, as she unfolds her rich abundance in the recesses of forests, lawns and marshes; an observation which must be continued from day to day and from year to year if we would reap the true reward of our labor."

At the period when von Schweinitz and Albertini wrote there had been recently broached, in some of the German Journals, particularly Voight's Magazine, certain monstrous hypotheses, concerning the very nature of the fungi, and "which one could scarcely credit his senses in perusing;"—hypotheses which ascribed the existence of several species of these plants to mutations of form, alleging that the *Tubulina fragiforma* was nothing more than the progeny of the *Phallus impudicus*, which, growing old, at length became metamorphosed into a Lichen; thus, in the mere wantonness of authority, confounding with one scroll of the pen two great classes of the veg-

etable world and blending both into the animal kingdom. Against these and many similar heresies and hallucinations the authors do not fail to caution their readers.

This work was prepared under several disadvantages. The German writers on cryptogamia had, it is true, been found of great service in determining nice and difficult questions, and to them Albertini and von Schweinitz repeatedly acknowledged their obligations; but they had to lament that their remoteness from the richer treasures of scientific truth, the vast libraries of metropolitan cities, did not allow them to consult the productions of investigators who had preceded them.

At a subsequent period when treating of the fungi of America, von Schweinitz was enabled to profit by the contemporary labors of those whom he is pleased to term the coryphæi of mycological science, such as Fries, Nees, Link and Kunz, and he then takes occasion to remark, that all the genera described by them are likewise found in America, and that indeed but few species are known in Europe, (except those parasitic fungi which belong to hosts not found here,) but what are equally the products of both continents.

It is not perhaps among the least interesting and creditable circumstance connected with the publication of this work that twelve plates containing figures of ninety-three species of new fungi were drawn, engraved and colored by the hands of von Schweinitz himself. We are assured, by one who was at that period his pupil, that he "recollects the untiring research with which our departed friend amidst the various arduous duties of his office, (that of tutor at Niesky), pursued his favorite study, and the labor bestowed by his own hands on the colored plates of the well known '*Synopsis Fungorum*.'" The modesty with which the plates are submitted to the public, marks in a distinct manner, both the meritorious character of the man and the style of his Latin composition:

"*Si quis severior tabularum nostrarum contemplator, nonnulla in iis nec fortasse pauca, desideraverit—eum, ne prima sese artis excusoriæ tirocinia unico scientiæ amore duce et auspice tentata coram, habere obliviscatur rogatum velimus.*"

One might hazard the opinion, that even in more recent works of natural history, many far less creditable specimens of the same art have found place without being able to urge the apology that they were the first efforts of a tyro, and without the commendatory pleas that the love of science had guided and ushered them into public view.

In his paper on the genus *Viola*, von Schweinitz makes the interesting remark, that of all the American species of violet, thirty or

more in number, not one has an identical counterpart in any European species; that not more than one of the latter appears to have become naturalized in America; and that while Europe possesses about twenty species of the interesting genus, America has, as above stated, already numbered thirty and probably may yet add others from future explorations of her extensive northern regions.

In his descriptions of new American species of the genus Spheriæ, contained in the fifth volume of the Journal of the Academy, von Schweinitz states that of the 528 species which Dr. Fries describe, 330 had been observed by himself in America, and that besides what Fries had incorporated in his general abridgement, the new species amounted to 112, making the whole number then known 640; that the whole number of the American fungi, then observed (1825), fell little short of 2,000. He adds, "I am fully persuaded as many more remain undiscovered. Our immense forests, humid climate and variety of high rank vegetable productions, may well warrant this conclusion."

In this paper he describes twenty new species of American Spheriæ, respecting which, he remarks, that very few peculiar to America, spring directly from the soil, that is, from vegetable mould—for *none*, in fact, spring solely from *rocks* or their *unvegetalized* debris. Nearly all the fungi peculiar to America are parasitic, and this, considering the vast number of peculiar plants and trees of the higher orders, found in our country, may still account for the almost incredible multitude of fungous forms, belonging exclusively to this continent.

His last publication contains the names of 3,098 species of North American fungi, of which more than 1,200 are the fruits of his own labors, embracing of course the species previously described in his paper on the Spheriæ and those included in his Carolina Synopsis. If to these we add those plants described in his other works, we have an aggregate of nearly 1,400 new species added to the amount of botanical science by the talents and industry of a single individual; a number constituting no contemptible portion of the whole amount of human knowledge on this subject at the time.

At the decease of von Schweinitz the whole of his rich collection passed, by bequest, into the possession of the Philadelphia Academy of Natural Sciences. Independent of the fungi and other cryptogamous plants, the herbarium thus bequeathed to the Academy contained (1835) about twenty-three thousand species, either collected by von Schweinitz himself or procured by him through the agency

of his numerous and valuable correspondents in this and other countries.

This was truly then a life which humanity may contemplate with a calm delight; these were labors which science may review with a noble satisfaction.

With a laudable emulation of all the excellences which had, before his own day, given lustre to his name, and a clear perception of the truth that the virtue of ancestors sheds no *honor* on any but the *virtuous* of their offspring; with a zeal for the acquisition of knowledge, which, springing from an innate law of his being, afforded to his undertaking that pure gratification which, by another law of his being, knowledge alone could impart; with a benevolent desire to communicate whatever of delight the investigations of science and literature had infused into his own heart; with a love for the beauties of nature exhibited almost in infancy and which grew with the increase of every faculty and lasted to the closing period of his too short career; with a purity of mind and heart which made every truth of nature a lesson in virtue; with an intrepidity in the prosecution of scientific enterprizes which led him out of beaten tracks and taught him to find pleasure in threading those very labyrinths from which most other travellers in the paths of knowledge shrink in despair; with a clearness of method which enable him to communicate to others the full advantage of his own discoveries in these mazy haunts of nature; with a candor and fairness which never merged the man of honor in an effort unduly to elevate the man of science; never sought by questionable artifices to obscure or to hide the just reputation of others; with a benevolence of disposition which marked him to find everywhere in works of creation the traces of that beneficence which, in his *professional* character, it was his highest pleasure to portray and his most ardent desire to imitate; with a cheerfulness of disposition and a suavity of manners which rendered him an object of deep affection in every social relation; with a rectitude of purpose which won the confidence, while it formed the character of youth—and secured the gratitude, while it watched over the interests of age; with an assiduity which encountered the fatigues of many voyages, not always without peril, in the service of that cause to which he was devoted; with a patient continuance in years of toilsome effort to extend, by precept and example, the benign system of practical goodness and spiritual liberality which ever shone in his life and actions; with a distinct perception that the treasures accumulated in a life devoted to science are not for individual possession, but, in order to produce

their due effect, must in some degree be imparted as a common inheritance to the heirs of his genius and spirit; with these and similar characters which time might fail us to enumerate did Lewis David von Schweinitz fill up the measure of his usefulness and win for himself a title to the lasting gratitude of his fellow-beings.

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2. Synopsis Fungorum Carolinæ superioris secundum observationes Ludovici Davidis de Schweinitz, Soc., Nat., Cur., Lips., Sodalis, etc. Edita a D. F. Schwægrichen. E commentariis societatis naturæ curiosorum Lipsiensis excerpta. 1818 (?) 4to, 105 pp., and 2 plates.

3. Specimen Floræ Americæ Septentrionalis Cryptogamicæ, sistens muscos hepaticos hucusque in Am. Sep. observatos, or specimen of a systematic arrangement and description of the cryptogamous planto of North America, comprising a diagnostic description of all the hepatic mosses hitherto observed in North America, with ampler descriptions of a number of new species. By Lewis D. de Schweinitz, P. D., Raleigh, N. C., 1821, 8vo., 27 pp.

4. Attempt of a monography of the Linnæan Genus Viola, comprising all the species hitherto observed in North America. By Lewis D. de Schweinitz. Silliman's Am. Jour. Sci., Vol. V., (1822), pp. 48—81. Communicated July, 1821.

5. A Catalogue of Plants, collected in the North-western Territory, by Mr. Thomas Say, in the year 1823. By Lewis D. de Schweinitz. Keating's Nar. of Long's 2nd Exp., Vol. II., Phil., 1823, 8vo, 21 pp.

6. Analytical table to facilitate the determination of the hitherto observed North American species of the genus Carex. By Lewis D. de Schweinitz. Ann. of New York Lyceum, Vol. I., 1823, 8vo, 10 pp.

7. List of the rarer plants found nearEaston, Pennsylvania. Silliman's Am. Jour. Sci., Vol. VIII, pp 267-269, 8vo.

8. A monograph of the North American species of the genus Carex. By Lewis D. de Schweinitz and John Torrey. Ann. of New

York Lyceum, Vol. I., 1824, pp. 283-373, 8 vo., 6 plates. Edited by Dr. Torrey.

9. Description of a number of new American species of Spheriæ. Journ. of the Acad. Nat. Sc., of Philadelphia, Vol. V., 1825, pp. 3-17, 8vo., 2 plates.

10. Synopsis Fungorum in America Boreali media degentium. Trans. Am. Phil. Soc., of Phil. N. S., Vol. IV., pp. 141-318, 1831, 4to., 1 Plate.

There is also in the possession of his son, Bishop de Schweinitz, of Bethlehem, Pa., a manuscript work entitled: "Synopsis Fungorum Americanorum qui Ludovicus David de Schweinitz innotuere. Secundum Systema Fries." This work is different from No. 10, but whether written before or after is unknown. The manuscript is carefully written in three bound volumes, 8vo.: the first having 116 pp., the second 175 pp, the third 100 pp. Some of the pages except the running title on the top are blank and were evidently to be filled out as the researches proceeded.

Other works, especially monographs were most probably written and remained in manuscript, but there whereabouts are unknown.

A tabular view, as arranged by Mr. Johnson, of the works named in this bibliography is appended:

TITLES.	WHERE PUBLISHED.	Date.	Whole No. of genera included.	Whole No. of species included	New genera described.	New species described.	Pages of the paper & their size.	Species or genera figured.	REMARKS.
Conspectus Fungorum Lusatiæ, &c.,	Leipsic,	1805	72	1130	2	127	412 8vo.	93 species in 12 plates	Plates drawn, engraved and colored by Mr Schweinitz.
Synopsis Fungorum Carolinæ Superioris,	Leipsic Soc. Nat. Curiosorum Commentariis,	1818	76	1373	3	315	105 4to.	2 plates of new genera	The date of this paper is only mentioned on personal information.
Specimen Floræ Americæ Septentrionalis Cryptogamicæ, (containing the Hepatic Mosses),	Raleigh, North Carolina, Pamphlet form.	1821	7	76		9	27 8vo.		
Monography of Genus Viola,	Silliman's Jour. Vol. V, p. 48,	1821	1	30		5	34 8vo.		A synoptical table is appended to this paper.
Plants collected during Long's 2d expedition,	Keating's Nar. of Long's 2d Exp., Vol II, Phil.,	1823	94	130		11	21 8vo.		
Analytical table to determine the Carices.	Ann. of New York Lyceum, Vol. I,	1823					10 8vo.		With 110 autithetical positions of sp. ch. and reference to several new species.
List of the Plants of Easton, Pa.,	Sill. Jour., Vol. VIII, p. 267,	1824	85	150		4	2 8vo.		
Monograph of North American Carices,	Ann. of New York Lyceum, Vol. I, p. 283,	1824	1	113		6	90 8vo.	6 plates of new species	
New American species of Spheriæ,	Jour. of the Acad. Nat. Sc. of Phil., Vol. V., p. 3,	1825	1	20		15	14 8vo.	2 plates of new species	
Synopsis of North American Fungi,	Trans. Am. Phil. Soc. of Phil. n. s., Vol. IV. p. 141,	1831	246	3098	7	1203	177 4to.	1 plate of new genera	This synopsis contains the fungi described in the papers 2 & 9.

THE EFFECT OF PULVERIZATION ON FERTILIZER SAMPLES.

H. B. BATTLE.

That a sample of commercial fertilizer should be finely ground is not to be doubted. The necessity is more apparent in an ammoniated guano than in an acid phosphate, for with the former, where three or four ingredients enter into its constitution and too with properties so entirely different, it is extremely difficult to obtain a fair and impartial sample unless these constituents are finely ground and carefully mixed.

In a chemical analysis where the amount used is small, only two grms., in the more important determinations, all the accuracy possible is needed to procure a result that will represent the whole mass. It is customary that the sample shall be ground so as to pass a 20 mesh sieve, i. e., a sieve with 20 meshes to the linear inch or each mesh is $\frac{1}{20}$ inch square nearly. The meaning of this is not that each particle is $\frac{1}{20}$ inch square—for possible $\frac{1}{2}$ of the sample may pass in turn a 40 mesh and some even a 60 mesh without further grinding—but that none of the particles are *coarser* than $\frac{1}{20}$ inch square.

In an ammoniated fertilizer the nitrogenous materials, as horn or hoof, being tougher are disintegrated and pulverized with most difficulty, while the phosphatic constituents with particles even harder are ground much finer, friction between the particles themselves assisting in the action. If such a fertilizer, after being ground to pass a 20 mesh seive and bottled, is even slightly shaken the finer particles of phosphate settle to the bottom, leaving the coarser nitrogenous mass at the surface, and a sample from the top will give a result to some extent at variance with that lower down. This settling is the more noticeable when the moisture is not present in large amount. Finer pulverization then is absolutely necessary to secure the best results. But besides giving a more uniform mass there are other results connected with finer grinding which I have endeavored to show in the present paper.

For comparison, both acid phosphates and ammoniated fertilizers were taken and each sampled after being passed through sieves of 20, 40, 60 and 100 meshes to the *linear* inch.

A. Is a high grade acid phosphate.

B. A medium grade acid phosphate.

C. An ammoniated guano.

D. Ammoniated guano with an extremely high per cent. of Insoluble Phosphoric Acid.

E. Ammoniated guano—in the 20 mesh sample illustrating in a marked degree what has been before stated concerning the settling of the finer particles.

TABLE I.

	H_2O.	Decrease in H_2O from 20 mesh.	Sol. P_2O_5	Insol. P_2O_5	Ins. P_2O_5 calculated Water free Sub.	Decrease in Ins. P_2O_5 from 20 mesh, (from previous calculation.)
A. 20 mesh,	15.04		11.86	1.28	1.50	
60 m.,	10.05	4.99	12.32	.92	1.02	.48
B. 20 m.,	15.68		8.16	3.77	4.46	
60 m.,	11.89	3.79	8.49	3.74	4.24	.22
C. 20 m.,	12.83		5.35	1.62	1.86	
40 m.,	11.72	1.11	5.72	1.46	1.65	.21
D. 20 m.,	11.46		5.07	7.15	8.07	
40 m.,			4.98	7.10		
60 m.,			5.08	7.36		
100 m.,	8.28	3.18	5.05	7.29	7.95	.12
E. 20 m.,	10.81		3.95	3.93	4.40	
40 m.,	11.06		3.81	3.74	4.25	.15
60 m.,	11.28		3.75	3.30	3.72	.68
100 m.,	9 96	.85	3.66	3.07	3.40	1.00

We see at once several noteworthy results attended with the pulverization, viz: the loss of water, and the decrease of the Insoluble P_2O_5; the reason for the former is obvious; the latter is due to the greater solvent action of the ammonium citrate used in its determination on the finer particles caused by the pulverization. The loss of moisture has the effect of increasing the content of the other substances—a mere withdrawal of water, of course, raising other constituents—which is the case with the total P_2O_5, total Potash, &c., and would be so with the insoluble P_2O_5 were it not for the easier solution of the finer than the coarser particles. This decrease of Insol. P_2O_5 is enough to counteract the increase caused by the loss of water and cause a still further decrease amounting in extreme cases to nearly 25 per cent. of the total amount of Insol. P_2O_5 present in the original sample.

I will add that the loss of water in A. and B. is rather excessive, part of which being due to artificial drying as the sample was too wet to pass the fine seive.

It will be seen that the decrease of Insol. P_2O_5 in D. is very slight, only .12 per cent. from 20 to 100 mesh. I was at a loss to understand this remarkable deviation from the other results until after the determinations were completed, when I found from the manufacturers that the basis of the phosphate was a natural guano instead of a manipulated superphosphate. The reason then was plain—ammonium citrate solution acts no quicker on fine than on coarser particles of raw phosphate.

For the sake of comparison other results are calculated and given in Table II.

TABLE II.

	H_2O.	Sol. P_2O_5	Insol. P_2O_5	Total P_2O_5	Rev. P_2O_5	Avail. P_2O_5
A. 20 m.,	15.04	11.86	1.28	14.98	1.84	13.70
60 m.,	10.05	12.32	.92	15.76	2.52	14.84
B. 20 m.,	15.68	8.16	3.77	14.74	2.81	10.97
60 m.,	11.89	8.49	3.74	15.32	3.09	11.58
C. 20 m.,	12.83	5.35	1.62	8.92	1.95	7.30
40 m.,	11.72	5.72	1.46	9.02	1.84	7.56
D. 20 m.,	11.46	5.07	7.15	13.50	1.28	6.35
40 m.,		4.98	7.10			
60 m.,		5.08	7.36			
100 m.,	8.28	5.05	7.29	13.93	1.59	6.64
E. 20 m.,	10.81	3.95	3.93	10.04	2.16	6.11
40 m.,	11.06	3.81	3.74	10.02	2.47	6.28
60 m.,	11.28	3.75	3.30	10.00	2.95	6.70
100 m.,	9.96	3.66	3.07	10.13	3.40	7.06

From the last table we see that incident to the loss of water and decrease of Insol. P_2O_5 is an increase of Total and consequently an increase of reverted and available P_2O_5, amounting in some cases to nearly one per cent.

To summarize then we have for the results of pulverization of fertilizer samples:

1. The more perfect mixing of the separate ingredients, and the consequent susceptibility to better and fairer sampling.

2. The loss of moisture, due partly to the vaporizing of water by heat generated by grinding, and partly to the action of the air on the finer particles necessarily exposed during the pulverization.

3. The decrease in content of Insoluble Phosphoric Acid caused by the more complete action of the solvent on the finer particles.

4. The increase of the Total Phosphoric Acid caused by the loss of moisture.

5. The increase of the Reverted and Available Phosphoric Acid due first to the increase of the Total, and second to the decrease of the Insoluble.

The last four results are shown to be directly proportional to the fineness of the grinding.

In conclusion, I would suggest the advisability of passing the fertilizer sample through a 40 mesh sieve, instead of 20 as is the custom now. This would give better mixing and consequently a more reliable sample could be taken, and again the fineness obtained would more nearly approach what is required by the plant in the process of its growth. It would not have the disadvantage of the 20 mesh, nor the objection met with in the 100 mesh grinding; neither the coarse mass sampled with difficulty in the former, nor the too great loss of water in the finer particles and the greater solvent action on them in the latter. H. B. BATTLE.

Laboratory N. C. Exp. Station,
Raleigh, May 19th, 1886.

ON THE LOSS OF MOISTURE IN BOTTLED SAMPLES.

H. B. BATTTE.

Frequently having had occasion to repeat a determination of total phosphoric acid in a commercial fertilizer, I almost invariable found the second determination made two or three weeks subsequent to the first to give a higher result. This variation being so constant I was forced to think that it was not the result of error of analysis, but owing to loss of moisture in the samples.

The samples of fertilizers used were placed in a wide mouth bottle about 2 oz. capacity and closed with ordinary cork. Five distinct

weighings were made from each bottle which was unavoidably kept open during the process of each weighing—the bottle in the meantime subjected to the ordinary heat of the laboratory.

To test this theory of loss in moisture I selected six samples of ammoniated fertilizers entirely at random from a lot of thirty or forty. The first determination of moisture was made one hour after sampling, and the second after the lapse of one month—with the results given below:

TABLE I.—MOISTURE at 100° C.

	1 Hour after Sampling.	1 Month later.
1	18.64	17.83
2	17.42	15.73
3	20.12	19.40
4	16.15	15.94
5	12.03	10.70
6	16.38	15.36

TABLE II.—DECREASE OF MOISTURE.

No. 1 has decreased in moisture in 30 days, ...0.81 per cent.
" 2 " " " " ....1.79 "
" 3 " " " " .... .72 "
" 4 " " " " .... .21 "
" 5 " " " " ....1.33 "
" 6 " " " " ....1.02 "

Table II shows an invariable decrease in moisture, which has the effect of elevating the per cents. of the other constituents to a marked degree. For example, in No. 2 where the decrease is greatest, the sample contained at the time of the first weighing 9.77 per cent. total phosphoric acid. Theoretically this would be raised at the second weighing, on account of the loss of 1.79 per cent. moisture, to 9.98 per cent., an increase of 0.21 of total P_2O_5. Practically this increase was found to exist, by actual analysis, 30 days after the first determination.

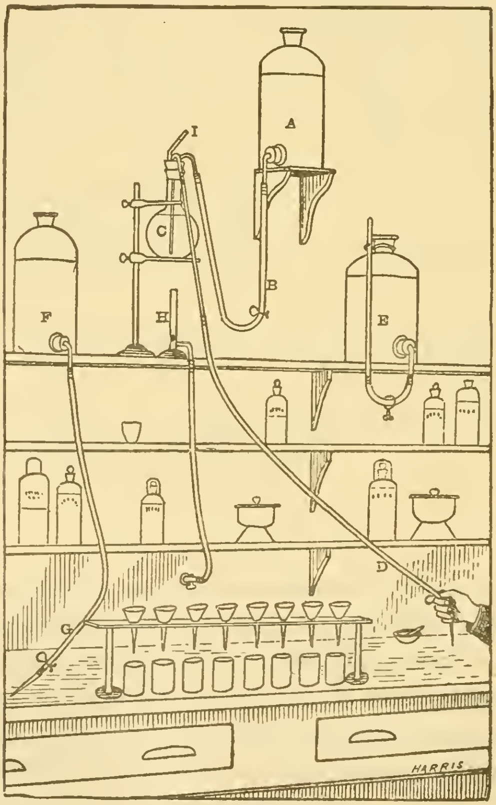
As a remedy to prevent this loss of moisture and consequent disarrangement of two sets of determinations, the use of tightly fitting rubber stoppers is recommended—even then a loss is liable to occur from the frequency of the weighings and exposure to air. The necessity of fitting in the rubber stopper tightly after each weighing will be observed.

H. B. BATTLE.

Laboratory N. C. Ag. Exp. Station.

AN IMPROVED WASH-BOTTLE FOR CHEMICAL LABORATORIES.

H. B. BATTLE.



By this simple device the washing of precipitates and the cleansing of vessels used in the process of analysis, which before required

the use of the ordinary wash-bottle, can now be done with much more facility and in a much shorter time.

It consists essentially of a thin glass flask, C, placed about three feet above the level of the working desk, closed by a three-hole rubber stopper. Through one of these holes issues a rubber tube, D, (or glass with rubber connections) from the bottom of the flask descending to the desk and ending in a glass nozzle. Connection is made by a second hole in the stopper with a reservoir bottle, A, placed above the top of the wash bottle. In the third hole is placed a glass tube bent at an angle to keep out dust. On filling the flask from the reservoir—the flow being stopped by a pinch-cock—the water is started by suction from below, and the stream through the nozzle can be regulated or stopped at will by a pinch-cock placed conveniently to the hand, the height of the flask furnishing the pressure which is sustained by the siphon. A bunsen burner, H, is placed underneath the flask, and the water can be heated when it is so required—the open tube, I, allowing for the escape of steam. Hot water as well as cold can thus be used in treating precipitates. Other solutions can be employed equally as well as water, (see bottle F.)

The advantages of this system are:

1st. The saving of much time and the consequent labor attending the use of the ordinary wash bottle, especially where several analyses are carried on at the same time, the exertions required by the mouth and lungs being thereby avoided.

2d. No air exists in the tube as in an ordinary wash bottle, and consequently the full force of the liquid is utilized immediately.

3d. Precipitates can be washed and small flasks cleansed much more satisfactorily than by the old system.

4th. When used with a wash solution of ammonia water no trouble is experienced with the free ammonia which ordinarily is quite hurtful to the mouth and eyes.

The large bottle E, with the accompanying tube, shows a convenient arrangement for holding any solution and delivering the same.

Laboratory of the N. C. Ag. Expt. Station, Raleigh.

METEOROLOGICAL RECORD AT CHAPEL HILL FOR THE YEAR 1885.

F. P. VENABLE.

The following record is a continuation of that published in previous Journals of the Society, (I, p. 35, II p. 50), the observations being taken under nearly the same conditions of location, instruments, &c., as during the years 1880–1884. Some of the facts presented by the tables may be briefly pointed out and discussed:

TEMPERATURE.

The mean annual temperature is 57.87° as compared with 59 77° for the preceding five years. It is 1.55° below the average for twenty-one years. The average temperature for the seasons, is Spring 56.21°, Summer 77 34°, Autumn 58.65°, Winter 39.28°. For the previous five years these averages were 58 35°, 77.25°, 61.08°, 42.39°, respectively. This shows a summer warmer than the average and the remaining seasons some two degrees below the average. July, the warmest month, had a mean temperature of 79.64°, about one degree above the average. The warmest day of the year was July 9th, with a mean temperature of 86.25°. The maximum observed was 100° on July 9th also. These are to be compared with 90 7° on July 12th, 1880, and 102° on July 22nd, 1883. The coldest month was February, 36.04°. This is the coldest monthly mean in six years and is nearly 11° below the average for February. The coldest day was February 12th, with a daily mean of 17.50°. For January 6th, 1884, the mean was 10.50°. On February 11th the thermometer reached 9°. On December 30th, 1880, it registered –2°. The observations would show then a generally cold year with a hot summer, yet one in which no great extremes of temperature were experienced.

HUMIDITY.

The annual mean is 70.60, a little below the average. October was the month of greatest humidity and April the least. The mean saturation for Autumn is lower than usual, for the remaining seasons higher.

RAINFALL.

The total rainfall, 46.51, inches is five inches above the average, 41.64. The heaviest rainfall was during September, the total

amount being 6.45 inches. On September 21st there was a remarkable rainfall of 5 11 inches. This is the heaviest on record here. The nearest approach to it was on April 22nd, 1883, when 4.19 inches fell. Spring was a little below the average; Summer 4 inches below; Autumn 8 inches above; and winter about 2 inches above, showing a very unusual distribution of the rainfall. The summer was noted for the succession of prolonged droughts. From June 8th to July 11th, or 33 days, the fall was .43 inches; from July 24th to August 28th, or 35 days, the fall was .22 inches; from August 30th to September 20th, or 21 days, the fall was .74 inches. The August rainfall was less than half the average.

WINDS AND SKY.

The winds were mainly from the west and southwest, the northeast and northwest winds coming next on the list. As to clouds, the rule for the year seemed to be fair days rather than those heavily clouded or entirely clear. Both the clear and cloudy days were below the average in number. The autumn, winter and early spring months have the greatest number of clear days. The cloudless observations (clear) were 402 out of a total of 1,045.

The barometric range was 1.6 inches—the highest in six years.

GENERAL REMARKS.

The year as a whole shows wide variations from the average and is one to be remembered. The spring was very late as the expression in common use goes. The first wild flowers appeared some six weeks after the date on which they were usually found. Foliation of forest trees began only on April 25th. This is several weeks late and the bare look of the trees during the month when everything is usually covered with the green spring growth was very noticeable. The succession of droughts in the summer proved of course injurious to the crops, though fortunately they commenced too late for injury to the small grain, and when the corn had already a good stand and the fall rains came in time to partially save the cotton. The season seemed a fair one for tobacco. The fall was a late one, free from heavy frosts, so that even tender plants remained uninjured in the gardens long after the usual time. The leaves remained on the trees until about December 5th, and the remainder of the year was open and pleasant.

The appended table needs no further explanation.

F. P. VENABLE.

	Jan.	Feb.	March	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	5 Y'rs.
Temperature—Monthly Mean,	39.23	36.04	42.87	58.57	67.20	75.70	79.64	76.69	69.71	58.20	48.04	42.56	58.75	59.77
7 A. M. Mean,	33.90	30.36	35.97	51.72	61.77	72.29	74.35	72.32	62.69	49.71	40.69	36.80	51.88	54.32
2 P. M. Mean,	46.50	44.79	51.13	70.07	77.30	86.04	91.55	88.19	81.43	73.75	60.41	53.96	68.76	68.02
9 P. M. Mean,	38.42	34.25	42.27	57.83	64.57	72.43	76.45	71.13	67.31	54.75	46.79	40.67	55.57	57.44
Max. daily Mean,	67.50	57.75	58.00	74.75	77.00	83.50	86.25	85.50	77.25	68.75	68.75	63.50	86.25	90.70
Min. daily Mean,	21.50	17.50	27.25	36.00	56.00	66.00	68.50	64.25	59.00	44.50	36.00	30.75	17.50	9.00
Max. observed,	77	65	75	94	90	94	100	99	92	81	71	74	100	102
Min. observed,	14	9	17	31	41	63	61	57	46	35	27	23	9	-2
Humidity—Monthly Mean	71.65	76.33	68.09	62.83	67.78	67.03	72.36	69.64	75.01	78.60	74.11	63.79	70.60	71.18
7 A. M. Mean,	83.75	83.21	79.16	73.34	79.37	77.75	82.75	82.20	85.86	89.71	83.69	78.06	81.57	80.15
2 P. M. Mean,	59.28	65.14	55.83	46.86	51.42	52.02	51.81	51.06	56.96	60.07	58.79	48.92	54.84	57.59
9 P. M. Mean,	74.76	80.44	72.58	67.57	73.48	75.13	76.98	75.65	82.21	84.79	77.71	64.56	75.51	76.06
Min. observed,	25	18	21	19	22	30	28	29	32	31	25	20	18	17
Rainfall, total,	5.24	2.73	3.50	2.71	4.34	1.32	3.95	1.98	6.45	6,27	3.81	4.21	46.51	41.64
Cloudy days,	8	7	6	4	4	2	2	3	3	4	2	2	47	66.4
Clear days,	6	7	7	6	0	2	1	3	3	7	9	11	62	78.2
Cloudy observed,	41	27	34	24	30	27	23	28	28	22	27	16	327	------
Fair observed,	16	11	20	27	30	36	40	33	38	25	17	17	316	------
Clear observed,	32	40	37	37	24	22	25	29	22	46	44	44	402	------
Winds—North,	3	5	2	2	5	1	3	1	1	0	3	2	28	68.4
Northeast,	17	14	14	9	15	8	8	22	20	14	7	17	165	134
East,	4	1	5	12	5	5	6	13	19	17	0	1	88	138.6
Southeast,	0	3	2	6	6	7	8	4	4	6	1	0	52	87.4
South,	0	0	5	5	0	12	1	2	1	2	0	0	28	64
Southwest,	33	24	29	29	25	23	11	21	10	10	19	16	250	161.4
West,	35	27	23	8	19	20	46	16	27	37	35	14	287	217.6
Northwest,	13	7	12	16	14	9	7	10	5	8	21	27	139	167
Barometer--Monthly Mean	30.205	30.040	30.095	30.084	29.954	30.075	30.013	30.011	30.079	30.007	30.016	30.117	30.058	------
Max. observed,	30.783	30.492	30.541	30.545	30.161	30.284	30.211	30.227	30.272	30.287	30.378	30.730	30.783	30.759
Min. observed,	29.691	29.393	29.633	29.672	29.497	29.728	29.757	29.706	29.648	29.321	29.662	29.492	29.321	29.424
Range,	1.092	1.100	.908	.873	.664	.556	.454	.521	.624	.966	.716	1.238	1.462	1.335

ON THE DETERMINATION OF POTASH.

F. B. DANCY.

Very discordant results seem to be reached by the agricultural analytical chemists all over the country in the determination of potash in commercial manures and commercial potash salts. Even determinations in chemically pure salts seem to give trouble. The "Potash Committee," of the Association of Official Agricultural Chemists, last year sent out specially prepared samples to various chemists all over the country to get their determinations of potash in identical samples for purposes of comparison. These results were so discordant that they were sent around to the different chemists confidentially, and are still preserved as one of the trade secrets! We did not find time at the Station to have a hand in those determinations (1885), but I have just completed determinations in the "Potash Committee's" samples of this year (1886), the results of which are very satisfactory and may prove of interest.

There is a well recognized tendency, oftentimes pointed out, towards high results in potash determinations. But I see no reason why, with reasonable care, a determination of potash may not be made as accurately and be as reliable as any other.

The Committee's samples were six in number: 1 was chemically pure sulphate of potash; 2 was kainit; 3, 4 and 6, so far as could be judged, were acid phosphates with potash; and 5 was a complete manure, ammoniated with an abundance of cotton seed meal.

It was decided first to make three parallel determinations of K_2O in the chemically pure sulphate (No. 1), in slightly different ways. The per cent. of K_2O in K_2SO_4 Fresenius gives as 54.092; more recent atomic weights (Clarke in "Constants of Nature") make it 54.062.

One gram of the K_2SO_4 was very carefully weighed out and dissolved up to 1,000 c. c. in distilled water. Three aliquot portions of 100 c. c. each (containing 0.1 gram K_2SO_4) were measured out into beakers and the volume brought to about 150 c. c. The three determinations will be designated by a. b. and c.

a. Heated to boiling; added $BaCl_2$, drop by drop, with constant stirring, in slight excess; *filtered*; to filtrate added 1 c. c. strong ammonia (NH_4HO) and then, drop by drop with constant stirring, a saturated solution of carbonate of ammonia ($(NH_4)_2CO_3$) as long

as precipitate formed; [adding the reagents, drop by drop with constant stirring, is supposed to prevent the mechanical incorporation by the precipitates of any of the potash salt, and for same reasons unnecessary excesses of the precipitants are to be avoided,] *filtered ;* evaporated the filtrate to dryness in platinum dish, drove off ammonia salts and took up in hot water; filtered through a small filter into a porcelain dish, added 10 c. c. of solution of chloride of platinum ($PtCl_4$) and evaporated so low that the mass solidified on cooling; took up in 85 per cent. alcohol, filtered through a small filter and thoroughly dried, filter and precipitate; weighed them in a weighing bottle; extracted K_2PtCl_6 from filter with hot water, thoroughly dried the filter again and weighed in weighing bottle. Difference is K_2PtCl_6 yielded by 0.1 gram. K_2SO_4.

b. Heated to boiling; added $BaCl_2$, drop by drop with constant stirring, in slight excess; then, *without filtering*, precipitated the excess of barium by $(NH_4)_2CO_3$, drop by drop with constant stirring, after having made the solution alkaline with 1 c. c. NH_4HO as in *a; filtered;* the rest of the manipulation is identical with *a*. [The only difference between *a* and *b* is one more filtration in *a*. In *b* the barium sulphate and barium carbonate precipitates were thrown down together; in *a*, separately, a filtration intervening. The double filtration in *a* is not necessary but it extends the manipulation.]

c. Was treated *just like a fertilizer*, by the so-called "Washington method," proposed by the committee who sent out the samples.

The remaining five samples were treated in the same way. In case of the kainit (No. 2) 10 grams were dissolved up to 1,000 c. c. and 25 c. c. taken for the analysis, equal to 0.25 grams substance; in the cases of 3, 4, 5 and 6, 10 grams were dissolved up to 1,000 c. c. and 100 c. c. taken for the analysis, equal to 1.0 gram of substance.

Perhaps a synopsis of the method had best be given:

Heated to boiling; added $BaCl_2$, drop by drop with constant stirring, in slight excess; then added (without filtering) $Ba(HO)_2$, drop by drop with constant stirring, to alkaline reaction; filtered; to filtrate added 1 c. c. strong NH_4HO, and then, drop by drop with constant stirring, a saturated solution of $(NH_4)_2CO_3$ as long as a precipitate formed. [Just here, instead of adding ammonium oxalate (or oxalic acid) immediately, as the method calls for, I filtered from the precipitate with $(NH_4)_2CO_3$ and added the ammonium oxalate (0.75 gram) to the filtrate. The result was that a slight precipitate appeared in every case, except that of the chemically pure K_2SO_4,

exhibited by a cloudiness that was greatest in 6, nearly as much in 3, next in 2, next in 4 and very faint in 5. They were all slight, but tend to show that the addition of oxalate may be necessary for another reason than, in the language of the committee, "to facilitate the conversion of any nitrates of potash which may be present into carbonates upon subsequent evaporation and ignition."] After adding the ammonium oxalate the solutions were evaporated to dryness in platinum dishes, volatile matters (ammonia salts) expelled by heating below red heat and the residues taken up in small amounts of hot water, and filtered through small filters in porcelain dishes; 2 drops HCl were added and then 10 c. c. $PtCl_4$ solution; evaporated until mass solidified in cooling; took up in 85 per cent. alcohol and finished as laid down in *a*.

This method of weighing I regarded as superior to all others in point of accuracy, and hence, contrary to the committee's recommendations, I preferred to vary from the method in this slight particular, inasmuch as I do believe it advisable to wash the precipitate out with water and weigh the filter again afterwards. Furthermore I believe that the nicety of adding the reagents, drop by drop with constant stirring is in commercial analysis unnecessary.

RESULTS.—In the chemically pure K_2SO_4 determinations:

a.	gave	K_2PtCl_6,	0.2801 gram, =	K_2O,	54.08	per cent.
b.	"	"	0.2805 gram, =	"	54.16	"
c.	"	"	0.2829 gram, =	"	54.62	"

The *per cents* are seen to be quite close together, but it is to the *weights* of K_2PtCl_6 that we should look, since the per cents vary according to the amount of substance taken—in this case very small, 0.1 gram. The per cent. in *c* is much higher than the theoretical, but the smallness of the amount worked with must be borne in mind. The *weights* of K_2PtCl_6 are very satisfactorily near together. A tendency to high result (*c*) is shown probably from extended manipulation introducing foreign substances into the solution.

1.0 gram of substance is the amount taken in potash determinations in commercial fertilizers and was the amount taken in the committee's samples in this work, 3, 4, 5 and 6. Now suppose the above three weights of K_2PtCl_6, instead of coming from the very small 0.1 gram, came from 1.0 instead. The corresponding per cents of K_2O would be 5.41, 5.42 and 5.46, which are very satisfac-

tory results and as concordant as results obtained in most any other kind of determination.

I had thought of making check determinations on my results in samples 2, 3, 4, 5 and 6, but the satisfactory agreement of the results of the three determinations of 1, made me consider further work unnecessary.

F. B. DANCY.

Agricultural Experiment Station, Raleigh, N. C.

PROPENYL-ISO-TOLUYLEN-AMIDINE*.

(Propionyl-anhydro-iso-diamido-toluol.)

J. M. PICKEL.

Amidines are, as defined by Beilstein (Handbuch der Org. Chem. p. 225), acet amides in which the atom of Oxygen is replaced by the bivalent group NR. Thus, C_xH_y CONH$_2$, an amide, becomes C_xH_y C(NH)NH$_2$, an amidine, when O is displaced by (NH). The H's both of the group NH and of NH_2 may, of course, be replaced by carbo-hydrogen radicals, e. g., $CH_3CH_2\,C\begin{smallmatrix}-NH\\=N\end{smallmatrix}\begin{smallmatrix}C_6H_5\\C_6H_5\end{smallmatrix}$, propenyl-diphenylamidine. If, instead of the two phenyl groups, we have the bivalent toluylen group, $C_6H_3CH_3$, the compound becomes $CH_3CH_2\,C\begin{smallmatrix}-NH\\=N\end{smallmatrix}C_6H_3CH_3$ propenyltoluylenamidine. Compounds of this last class are anhydrous. Two special examples will illustrate the two ways of making them:

1. Ortho phenylendiamine is heated with acetic acid.

$$C_6H_4\begin{matrix}NH\,H \\ NH_2 \quad + CH_3CO\,OH\end{matrix} = H_2O + C_6H_4\begin{matrix}NHC\,O\,CH_3 \\ N\,H_2\end{matrix} =$$

$$C_6H_4\begin{matrix}N-H \\ N=\end{matrix}C.CH_3 \times 2H_1O.$$

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*An abstract of experiments undertaken at the suggestion of the late Prof. Hübner and executed in his laboratory at Gŏttingen. J. M. P,

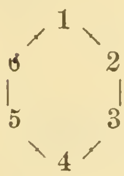
2. Orthonitroacetanilide is reduced,

$$C_6H_4\begin{matrix}NHCOCH_3\\NO_2\end{matrix} + H_6 = 2\,H_2O + C_6H_4\begin{matrix}NHC\boxed{O}CH_3\\N\boxed{H_2}\end{matrix} = C_6H_4\begin{matrix}NH\\N=\end{matrix}C.CH_3 + H_2O.$$

It has been found that only those compounds in which the NH_2 group is in *ortho* position to the $NHOC_xH_y$ group are capable of forming these amhydro-bases.

In the toluol and homologous series, two sets of anhydro-bases are possible.

For convenience let us number the carbon-positions in the benzol-ring thus:



Then with CH_3 at position 1 we may have first,

$$\begin{matrix}(3)\ NH-\\(4)\ N=\end{matrix}C.C_xH_y \text{ or } \begin{matrix}(3)\ N=\\(4)\ NH-\end{matrix}C\,C_xH_y\text{; secondly,}$$

$$\begin{matrix}(2)\ N=\\(3)\ NH-\end{matrix}C.C_xH_y \text{ or } \begin{matrix}(2)NH-\\(3)N=\end{matrix}C.C_xH_y.$$

The two sets are isomeric. The base under consideration here, Propenyl-iso-totuylen amidine, belongs to set (2).

In building this base, Orthotoluidine was taken as the starting point. It was necessary to nitrate this compound in such a way as to bring the nitro group into *ortho* position to the amido group. The two following principles suggest how that result was to be accomplished: (1.) If a negative element, e. g., bromine, or a negative group, e. g., NO_2, is introduced into a Benzol ring which already contains a positive group, e. g., NH_2 or $NHCOC\,H_y$,—there will result *para* and *ortho* compounds mainly; (2.) If, however, the group or element already present is negative, a *meta* compound chiefly will be produced. Direct nitration of ortho toluidine or of ortho-acettoluide would, therefore, give a compound in which the nitro group wouid be in *para* relation to the amido group, e. g., CH_3 (1), $NHCOC_xH_y$ (2), NO_2 (5), and which in consequence would not serve our purpose. If, however, bromine be introduced before nitration, there would result a compound in which Br would have the place assigned in the above formula to NO_2. This, nitrated, would furnish a body in which the NO_2 group would occupy the desired ortho position, CH_3(1), $NHCOC_xH_y$(2), NO_2(3), Br(5); the latter would now have only to be reduced and the atom of bromine

displaced by one of hydrogen, and our end would be accomplished.

In accordance with the above considerations acet-ortho-toluide was bromated, nitrated and the acetyl-group displaced by the propionyl* group. The resulting compound furnished, upon reduction with tin and hydrochloric acid.

Propenyliso-bromtoluylenamidine,

$$C_6H_2\left\{\begin{array}{l} iCH_3 \\ oNH- \\ dmN= \\ BmBr \end{array}\right. \!\!C.CH_2.CH_3 \text{ or } C_6H_2\left\{\begin{array}{l} ICH_3 \\ \quad oN= \\ dmNH- \\ BmBr \end{array}\right. \!\!C.CH_2CH_3. \text{ This}$$

base, as also its salts, crystalizes well, and was easily characterized by analysis. (Let it be designated as bromine base No. 1.)

Treated in dilute alcoholic solution with amalgam of sodium it gave, after three to four weeks' boiling,

Propenylisotoluylenamidine:

$$C_6H_3\left\{\begin{array}{l} iCH_3 \\ oNH- \\ mN= \end{array}\right. \!\!C.CH_2CH_3 \text{ or } C_6H_3\left\{\begin{array}{l} CH_3 \\ oN= \\ mNH- \end{array}\right. C.CH_2CH_3 \quad \text{This}$$

base and its salts crystalize beautifully, and their identity was fixed by analysis and otherwise.

The introduction of bromine into this compound was found easy of accomplishment; but—what is very interesting—the new bromine base, though containing, as the old, but one atom of bromine, was not identical with it. The following comparison will show the points of difference and of agreement:

		Bromine Base No. 1.	New Bromine Base.
Melting point		135 6	152 3
Hydrochloricacid Salt	Water of crystalization	= none.	none.
	Chlorine	= 12 95 per ct.	12.87 per ct.
	Soluble in 1000 parts of water	= 2.42 parts.	4 81 parts.
Platinum Salt.	Water of crystalization	= 4.16 per ct 2 Mol.	4.22 per ct. 2 Mol.
	Platinum	= 21.96 per ct.	21.95 per ct.
	Soluble in 1000 parts of water	= 0.9472 p'rts.	1.403 parts.

*Propionyl-ortho-toluide would, but for the expense, have been used from the outset.

The bases differ as to melting point and solubility and are clearly isomeric. We have in this fact an intimation, at least, if nothing more, that to our base is to be assigned the formula (a) and not (b):

$$(a)\ CH_3(1)\begin{smallmatrix}(2)N=\\(3)NH-\end{smallmatrix}C\,CH_2.CH_3 \quad (b)\ CH_3(1)\begin{smallmatrix}(2)NH-\\(3)N=\end{smallmatrix}C.CH_2.CH_3$$

This conclusion is reached by regarding the group –NH– positive, and =C= negative; this granted, we should expect, bearing in mind the principles given on page 41, that (a) would give, upon bromation:

$$CH_3\ (1)\begin{smallmatrix}(2)N=\\(3)NH-\end{smallmatrix}C.CH_2.CH_3,\ Br\ (6)\ \text{or}\ CH_3\ (1)\begin{smallmatrix}(2)N=\\(3)NH-\end{smallmatrix}C.CH_2.$$

CH_3, Br (4), (most probably the first).

Either would explain the isomerism; (b), on the contrary, would give

$$CH_3\ (1)\begin{smallmatrix}(2)NH-\\(3)N=\end{smallmatrix}C.CH_2.\ CH_3,Br\ (5)$$

which is the formula assigned to base No. 1, and is, therefore, not admissible. We therefore conclude that not (b) but (a) represents the constitution of our base. But the point cannot be regarded as settled by these considerations. Whether there exists in fact as in theory a difference such as indicated by (a) and (b) remains a question.

J. M. PICKEL.

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EFFECT OF FREEZING ON STANDARD SOLUTIONS.

F. B. DANCY.

I desire to call attention to apparent changes which were manifest in standard acid and alkali solutions after being frozen in the cold snap in January, 1886.

The solutions were those used in determining nitrogen in nitrogenous materials. One was a solution of sulphuric acid one-fourth normal (0.02 gramme SO_3 in each c. c.) and the other was a solution of potassium hydrate of such a strength that one c. c. of the pot-

ash solution neutralized one c. c. of the acid solution. Up to the time of freezing these solutions were in every day use in the determination of nitrogen in our laboratory, had been very carefully prepared in the beginning (by gravimetric determinations of SO_3 in the acid and careful titrations of the potash with the acid), and there was no reason to believe that any change had taken place in the solutions up to the time of freezing.

In the cold snap alluded to both solutions froze solid and remained so several days. Some time—perhaps a week—after the solutions had thawed it became necessary to use them. That they had undergone any change was not thought of, in fact that they had been frozen was for the moment forgotten. When, however, I began to titrate it was evident that the solutions were no longer in equilibrium. I then titrated successive portions of 10 c. c. of the acid solution. I found that it required successively in c. c. of the potash to neutralize, 11.03, 11.10, 11.10, 11.05, 11.05, 11.00, 11.02. These titrations were made on Saturday, January 23d, and, as has been stated, about a week after the solutions thawed. Appearances pointed to the phenomenon that the solutions had in melting been left in strata of different densities. Subsequent titrations seemed to confirm this. On Monday morning (January 25th) I again titrated three portions of 10 c. c., each of the acid solution, both solutions being so far undisturbed. It required 10.85, 10.80, and 10.80 c. c. of potash respectively. I then thoroughly shook up the potash solution, leaving the acid entirely undisturbed, and titrated again in the same manner. Now it required of the potash solution 11.52, 11.50, 11.50 c. c. I then thoroughly shook up the acid solution and all subsequent titrations then gave 9.70; i. e., 9.70 c. c. potash solution to neutralize 10.00 c. c. of acid solution. Thus it was seen that the freezing had apparently altered the strength of one or both solutions. I then determined the strength of the acid solution, by precipitating the SO_3 with $BaCl_2$ in two separate portions of 40 c. c. each. I got weights of $BaSO_4$ 2.2527 and 2.2532 grammes; mean, 2.25295 grs. $BaSO_4$, equal to 0.0193412 gramme SO_3 in one c. c. instead of 0.02 grs. SO_3 as it was made. Hence the acid solution had been apparently weakened by .00066 gramme SO_3 to the c. c. or, almost exactly had lost $\frac{1}{30}$ of its strength. Hence it would require only $\frac{29}{30}$ of a c. c. of standard potash to neutralize one c. c. of this altered acid, or 9.666 ∞ c. c. to neutralize 10.00 c. c. The facts show, by the titrations cited above, that 9.70 c. c. of the potash were required to neutralize 10. c. c. of the acid, and it would therefore appear that the potash solution was still standard—had

undergone no change. This was verified by titrating the potash with a standard acid solution and it was found to be correct.

Now it is not known whether the acid solution was or was not correct up to the time of freezing, but in the absence of any good reason to suspect its being wrong the presumption is that it was right.

Hence it *would appear* that the standard acid solution was weakened by being frozen, while the standard alkali was not affected. But whether this be true or not it is evident that neither solution was left in a homogeneous state upon thawing. So that when standard solutions freeze it is certainly necessary, upon thawing, to shake them up thoroughly, if not to examine carefully into their conditions as to strength.

F. B. DANCY.

Laboratory of the N. C. Ag. Exp. Station,
Raleigh, February, 15th, 1886.

INDIAN ANTIQUITIES OF CALDWELL COUNTY.

DR. J. M. SPAINHOUR.

In the well known "Happy Valley," of Caldwell county, about a mile below Patterson and seven miles north of Lenoir, on the lands owned by Rev. T. F. Nelson, situated near the present bank of the Yadkin river, showing no appearance of elevation, was found an Indian mound containing twenty-seven skeletons. It was triangular in shape, forty-six feet long on the sides, twenty-nine feet wide at the extremity, tapering to a point towards the river. The mound at the time of its examination was situated immediately on the south bank of the river, but the river-channel is supposed to have formerly been further to the north than at present.

On the north west side of this triangle, at the depth of about three feet, was found the remains of an old Indian "Chief," with his head north-east and feet south-west. The skeleton was lying on the bottom of the excavation, upon its face, the head resting in a large sea shell. The inner surface of the shell next to the face was carved with peculiar hieroglyphics. Around the neck were large beads made of sea shells. The arms were extended, bending at the

elbows, the hands resting a little more than a foot from the head on each side. Around each wrist was a bracelet, composed of copper and shell beads, alternating. The copper beads presented the appearance of having been hammered into thin sheets and rolled around the string, a part of which had been preserved by the oxidation of the copper. The copper beads were from one to two inches in length, and showed no appearance of having been cut, resembling the lead sinkers used by a small boy on his fishing tackle.

In close proximity to the bones of the right hand, which I think had grasped the handle, was an iron implement about five inches in length, and three-eighths to one-half inch in diameter, not sharp pointed, but smaller at the end away from the handle. The handle had been a piece of elk or deer horn, part of which had been preserved by the oxidation or rusting of the iron.

The left hand was resting on the convex surface of a sea shell, five inches in diameter, which contained in the concave surface about one hundred small beads of various sizes. The shell was beautifully carved with hieroglyphics.

Under the breast was a gorget shaped implement composed of some substance resembling horn, about two and one-half inches in diameter, perforated with holes, which I suppose had been used as some kind of an ornament.

Near his head, on each side, were crescent shaped copper pieces, one and three-quarter inches at their greatest diameter, which were probably used as ear ornaments.

Resting on the skull were three, and near the bones of the body were two, funnel shaped copper ornaments or arrow points with trimmed edges, and showing superior workmanship to anything else found in the mound, except the carvings of the sea shells. Two of them had locks of the old warrior's hair fastened securely by the oxidation of the copper.

On each side of this "Chief," lying parallel with his body, were two skeletons, with heads resting in the concave surface of large sea shells marked with hieroglyphics, the heads lying on the side, the faces toward the "Chief" and near the extended hands of the "Chief."

Around and over the "Chief" were the bones of a number of skeletons. Seven skulls could be traced distinctly, and it is probable there were many others, but the bones had been disturbed, probably by the plow, as the ground has been in cultivation for a long while, and the others could not be traced if there were any.

Over and around these skeletons, but in close proximity, were thirty-two finely polished celts, thirty-two rubbing stones, eleven

pipes, some of them of fine workmanship, with pieces of about twenty others, cut mica, black and red paint shaped in acorn hulls, pieces of native black lead, and many other stone implements of various shapes and designs, showing the veneration and esteem in which this "Chief" of the forest was held by those that loved him if such expressions can be applied to the savages of that day.

To the east of the burials described, though only a few feet distant, a cruel barbarity of the Indians was unearthed. There were two graves of the same kind, and a description of one will do to represent both, for they were near each other and probably buried at the same time. One skeleton immediately above the other, the upper skeleton had a large frame and was buried with the face down, the other, the skeleton of a smaller person, lying on the bottom of the excavatien, with arms and legs extended, and securely fastened by placing large stones on each extremity—certainly buried alive, so that they could travel to the happy hunting grounds together.

The other burials in the same mound were insignificant in comparison, and are scarcely worth a description.

The bones of these skeletons could be traced to the finger ends, by careful manipulation, in the dark river sand in which they were buried, but would crumble to pieces on being exposed to the air in a few moments.

I might suggest by way of conjecture that the copper composing the ornaments was probably brought from the Lake Superior mines, the shells from the Gulf of Mexico or the Atlantic Ocean, the mica from the ancient tunnels, found in excavating the hills of Mitchell county, the iron manufactured in some mysterious way by the Indians from the splendid magnetic ore found in great abundance within a mile of this mound, but this would be conjecture. I leave this part of the subject to the gentlemen who have the collection in charge at the Smithsonian Institution, where these relics of antiquity have been placed on exhibition.

I intend giving a further description of other interesting mounds found in the same locality.

J. M. SPAINHOUR.

Lenoir, *N. C.*, *May 8th*, 1886.

A COMPARISON BETWEEN THE WASHINGTON AND ATLANTA METHODS FOR THE ESTIMATION OF REVERTED PHOSPHORIC ACID IN COMMERCIAL FERTILIZERS.

H. B. BATTLE.

To determine the difference in results as obtained by the Washington and Atlanta methods was the cause of the set of determinations given below:

The *samples* taken were acid phosphates made from S. C. Rock and Navassa Rock—being regarded as types of the various manipulated phosphates. They were ground and mixed carefully so as to pass a $\frac{1}{25}$ inch mesh sieve, and were kept in closely stoppered glass bottles during the process of the analysis.

The *Washington Method*, as pursued in the determinations, was as follows: 2 grms. were ground in a small mortar with about 50 c. c. of water, allowed to settle, the liquid decanted on a filter and allowed to run into a 200 c. c. flask—this grinding and decanting was repeated twice, using pestle without rubber tip, and grinding moderately each time. The residue was then transferred to the filter thoroughly washed. In the filtrate diluted to 200 c. c. the *water soluble* P_2O_5 was determined in 50 c. c. (= $\frac{1}{2}$ grm.). The residue on the filter was then transferred to a flask of about 150 c. c. capacity, using 100 c. c. strictly neutral solution ammonium citrate (sp. gr. = 1.09) and placed in a bath previously heated to 40°C and kept there 40 minutes, shaking vigorously twice during the operation*—the temperature being kept constant at 40°C throughout the operation. The solution was then filtered with a pump of ordinary power, after which the residue was washed with one-half strength citrate solution three times, consuming about one hour in the washing. The residue after being dried and ignited was fused with $Na_2CO_3+KNO_3$ and the *Insoluble* P_2O_5 determined in the usual manner as for the *Total*—viz: fusing, taking up with H_2O and HNO_3, diluting to 200 c. c.,

*By the strict Washington Method the flask should be shaken every five minutes, this was reduced to twice during the 40 minutes, owing to the peculiar rotating bath used which is supposed to agitate the flasks slightly.

50 taken out ($= \frac{1}{2}$ grm.), precip. with ammonium molybdate. Kept in bath 2 hours at 50° or 60° then allowed to stand two or three hours in the cold, and filtered—washed with one-half strength ammonium molybdate. Dissolved in ammonia precipitated with magnesia mixture and allowed to stand at least five hours in the cold. Filtered and washed thoroughly with ammonia (1.9), dried, ignited and weighed.

The *Atlanta Method* was followed as was laid down by the Convention at Atlanta and Philadelphia, with the exception of the treatment with Magnesium Nitrate for the estimation of total P_2O_5, which was omitted, being regarded as unnecessary, owing to the absence of organic matter in the samples. The solution was made by strong HCl and digestion, and the method from that point pursued. In the estimation of the Citrate Insoluble P_2O_5, it was found impossible to prevent the finer particles of the phosphate from being carried mechanically through the filter by the washing with water after treatment with Ammonium Citrate solution. This was noticed in every case, and it is very probable that this affected the results of this particular determination. Subsequent experience with the method has found this to be the case more or less in every instance where an Acid Phosphate is treated, being absent in the Ammoniated Fertilizers.

In both methods the greatest care was observed and the similar determinations were made, not together but separately, as it was thought that this would test the methods and the comparison between the two better than by making the determinations together, for in the latter case if any error had been made in one it would have been followed in the rest, and the treatment in whatever way it was carried out would have made the results identical in all. For this reason each duplicate determination was made at different times, and each determination therefore represented the method *per se*, and the comparison thus better carried out.

The *Result* of the comparison is given in the table following. The figures in each case represent the average of two and sometimes three closely concordant duplicate determinations. *W* represents the Washington Method, and *A* the Atlanta:

	H_2O.	Sol. P_2O_5.		Insol. P_2O_5.		Total P_2O_5.		Reverted P_2O_5.		Available P_2O_5	
		W	A	W	A	W	A	W	A	W	A
Navassa Acid Phos.	9.58	6.50	6.35	8.25	5.64	17.04	16.45	2.29	4.46	8.79	10.81
Excess.		.15		2.61		.59			2.17		2.02
S. C. Acid Phos.	10.11	12 03	11.48	2.23	1.16	15.62	14.79	1.36	2.15	13.39	13.63
Excess.		.55		1.07		.83			.79		.24

Comments on the Result as shown in the foregoing table:

1. As to the Water Soluble P_2O_5, the Washington gives higher results in every case without an exception—due most likely to the harder trituration, the better washing, and the absence of the rubber-tipped pestle. But in the Atlanta some of the phosphate is precipitated in the flask, being washed through the filter by the first washing with water and immediately precipitated—while this is not the case in the Washington, and consequently this P_2O_5 is lost to the Soluble, yet it is more than counter balanced by the gain due to the trituration.

2. In the Citrate Insoluble P_2O_5, the Washington gives more than the Atlanta, due to three or more reasons: *a.* to the shorter heating; *b.* the lower temperature; and lastly, *c* owing to the fact that no phosphate is washed through the filter by the citrate wash, and so no loss takes place as in the Atlanta. While this latter is not very great yet it appreciably decreases the per cent. Insoluble, especially in the case of finely ground acid phosphates.

3. For the Total P_2O_5, the Washington invariably gives higher results, varying from one-half to one per cent., the fusion with sodium carbonate and potassium nitrate very probably brought some silica in solution, and hence possibly increased the per cent. of Total P_2O_5.

The Available P_2O_5 is larger in the Atlanta, varying from one-half to two per cent., and hence will come into favor very generally with the manufacturers.

The Atlanta requires much shorter time than the Washington in the manipulation—in respect to Water Soluble and Citrate Insoluble but in the preliminary treatment of the Total to effect solution it was found that the Atlanta using magnesium nitrate required much more time than the fusion and was much more impracticable, owing to the

frequent breaking of the porcelain capsules and consequent loss of substance; after this difficulty in the subsequent precipitation, &c., the advantage was in favor of the Atlanta Method as far as time is concerned.

H. B. BATTLE.

Laboratory N. C. Expt. Station,
Raleigh, Oct. 21st, 1885.

ANALYSES COMPARING THE BITUMINOUS COALS OF NORTH CAROLINA AND TENNESSEE.

H. B. BATTLE.

The high percentages of sulphur and of ash render bituminous coals of North Carolina inferior to others on the market, and on this account it is doubtful, even if their extent and locality would justify, whether North Carolina coal could compete with that of Tennessee or Virginia.

The analyses following compare North Carolina bituminous coal with the coal of Tennessee, while other analyses are appended as a matter of interest:

I. Represents the average of eleven analyses of samples of bituminous coal from as many different localities near Farmville, Chatham county, N. C.

II. Shows the character of the natural coke found near the same place.

III. Average of two analyses of samples from the Taylor place near Gulf, Chatham county.

IV. Gives mean of two analyses of semi-anthracite from Chatham.

V. Average of seven analyses of semi-anthracite from Rockingham county.

VI. Analyses of merchantable Tennessee bituminous coal sampled from a pile of fifteen tons sold in Raleigh.

TABLE A.

	I. Farmville Bituminous.	II. Farmville Nat'ral Coke.	III. Taylor Place Bituminous.	IV. Chatham Semi-An.	V. Rockingham Semi-An.	VI. Tennessee Bituminous.
Water at 115°C	1.52	.90	1.77	2.99	4.40	1.78
Volatile Combustible Matter,	29.30	4.75	34.12	5.65	9.68	35.60
Fixed Carbon,	51.43	68.33	57.67	77.30	48.76	58.57
Ash,	13.40	25.10	4.74	11.62	35.38	3.42
Sulphur,	4.35	.92	1.70	2.44	1.78	.63
Total,	100.00	100.00	100.00	100.00	100.00	100.00
Specific Gravity,	1.351	1.603	1.306	1.518	1.856	1.289
Weight per Cubic Yard, lbs.,	2277	2798	2245	2562	3122	2170

It will be seen that the Sulphur and Ash are extremely high, and only in one instance (III. Taylor Place Bituminous) can the North Carolina coal compare with the Tennessee analysis, having a somewhat higher percentage of each.

It is also noticeable that the weight of a cubic yard of Tennessee coal is in round numbers equivalent to a long ton, while those of North Carolina, owing to the presence of a larger per cent of ash, is somewhat more.

The existence of Sulphur I consider to be almost entirely due to the presence of iron pyrites. Oftentimes large glistening scales of pyrites can be seen when the coal is fractured. Besides this visible demonstration, analysis confirms this opinion, which is shown by the following table:

TABLE B.

	Coal.		Ash.
Water at 115°C	1.71	Silica	1.26
Vol. Com. Matter,	28.66	Ferric Oxide	5.51
Fixed Carbon,	58.93	Undetermined	.24
Ash,	7.01		
Sulphur,	3.69		7.01

Or in other words a sample of coal yields 3.69 per cent. of Sulphur and has 7.01 per cent. of Ash (a very low percentage); if all the sulphur present were combined with iron it would give a percentage of 6.92 of pyrites (FeS_2) which in burning would give off

sulphur to form 4.61 per cent. ferric oxide (F_2O_3). Analysis of the ash shows 5.51 per cent. Fe_2O_3, allowing a sulphur of .90 per cent. for other combinations, after all the iron needed by the sulphur to form FeS_2 is taken up.

Other analyses tend to prove the combination of Sulphur with Iron, for it is noticeable in every analysis that for a high percentage of Sulphur there exists a corresponding high per cent. of Ash, which would not apt to be the case were the Sulphur present in organic compounds.

H. B. BATTLE.

Laboratory N. C. Ag. Expt. Station,
Raleigh, Feb. 18th, 1886.

ON THE EFFECT OF USING DIFFERENT AMOUNTS OF ACID PHOSPHATE IN THE DETERMINATION OF SOLUBLE PHOSPHORIC ACID.

H. B. BATTLE.

The Association of Official Agricultural Chemists adopted the following method for the determination of Water Soluble Phosphoric Acid: "Bring 2 grms. on a filter; add a little water, let it run out before adding more water, and repeat this treatment cautiously until no phosphate is likely to precipitate in the filter. (The washings may show turbidity after passing the filter). When the substance is nearly washed, it is transferred to a mortar and rubbed with a rubber-tipped pestle to a homogenous paste (but not further pulverized), then returned to the filter and washed with water until the washings no longer react acid will delicate test paper. Mix the washings. Take an aliquot—determine phosphoric acid. &c."

I have observed that the amount of substance taken affects the result as obtained by the above method.

The substance experimented on was a finely ground acid phosphate, passing a 60 mesh sieve, and of high grade. 2 grms. was

taken as in method, and only 1 grm. as well for the comparison and the determinations were carefully duplicated:

Acid Phosphate.	*Sol.* P_2O_5.	*Average.*	*Difference.*
2 grms. taken,	12.32 12.35	12.33	0.39
1 grm. taken,	12 63 12.82	12.72	

The method was followed exactly in each case and the final washings did not react acid; and yet by using 1 grm. a result was obtained 0.39 per cent. higher than that found with 2 grms. as in the Association method. What causes this difference ?

Presumably because a larger surface proportion of the 1 grm. is exposed while on the filter to the action of the water than is the case with the 2 grms., and for this reason is more completely washed and more phosphoric acid is consequently dissolved.

H. B. BATTLE.

Laboratory of the N. C. Ag. Exp. Station,
Raleigh, May 6th, 1886.

ON THE DETERMINATION OF MOISTURE IN COMMERCIAL FERTILIZERS.

H. B. BATTLE.

Superphosphates manufactured from phosphate rock by treatment with sulphuric acid contain not only hygroscopic water from the dilute acid, but also water combined with calcium sulphate formed by the chemical action. And when organic matter is added in the preparation of ammoniated phosphates, moisture is again brought into the mixture, and this is more securely retained than hygroscopic water in the plain superphosphates. The difficulty met with in driving off the different forms of moisture in its estimation is two-fold: (1) the impossibility of expelling all combined water at 100°C, and (2), the likelihood of the oxidation of the organic matter if a higher temperature is reached, and so impairing the result.

(Report Phos. Acid Committee, Chem. Bul. U. S. Dept. Agr. No. 7, p. 11.)

To ascertain the time required for complete expulsion of moisture, such as is driven off at a constant temperature of 100°C, I have instituted a set ef experiments, using both acid phosphates and ammoniated guanos for the comparison and heating for different intervals. The portions were of two grammes each, carefully weighed in watch glasses, heated in steam bath, taken out and cooled in well-fitting dessicators, weighed, returned to bath, taken out, reweighed, &c. The heating was interrupted but I am satisfied the result was not seriously affected, as the time consumed in drying and weighing was short. The steam bath registered a constant temperature of a fraction less than 100°C, never more than 100°C, so that the possibility of the oxidation of organic matter was lessened. The actual percentages of moisture found are given in Table I. A and C are acid phosphates, B, D and E are ammoniates:

TABLE I.

MOISTURE IN PER CENTS. EXPELLED AFTER HEATING.—HRS.

	½ h.	1	2	3½	5	7½	8½	10½	12	13	16½	18½	21	21½	23	24½
A. Acid Phosphate,	----	----	----	9.46	9.89	10.30	10.38	10.62	10.69	11.20	11.89	11.89	----	----	----	----
B. Ammoniate,	----	---	---	11.54	11.72	12.08	12.11	12.31	12.40	12.53	12.63	12.97	13 02	13.12	13.12	----
C. Acid Phosphate,	14.69	14.92	15 08	15.25	15.26	----	----	----	----	---	----	15.46	----	----	15.46	----
D. Ammoniate,	----	----	----	9.34	9.46	9.62	9 75	9.92	9.97	10.12	10.28	10.65	10.71	10.81	10.81	----
E. Ammoniate,	7.08	7.16	7.30	7.49	7.60	---	---	----	----	----	----	8.16	----	----	8.28	8.28

In order better to compare the results, the per cents. of the total moisture present, as found at the different intervals, are calculated and given in the following table:

TABLE II.

PER CENT. OF TOTAL MOISTURE EXPELLED AFTER HEATING.—HRS.

	½	1	2	3½	5	7½	8½	10½	12	13	16½	18½	21	21½	23	24½
A. Acid Phosphate,	----	----	----	79.56	83.18	86.63	87.30	89.32	89.90	96.39	100.00	----	---	-----	-----	----
B. Ammoniate,	----	----	----	87.96	89.33	92.07	92.30	93.83	94.51	95.50	96.26	98 86	99.24	100.00	----	----
C. Acid Phosphate,	95.02	96.51	97.84	98.64	98.71	----	----	----	---	----	-----	100.00	----	-----	-----	----
D. Ammoniate,	----	----	----	86.40	87.51	88.49	90.20	91.77	92.23	93.62	95.10	98.52	99.07	100.00	----	----
E. Ammoniate,	85.71	86.68	88.38	90.68	92.01	----	---	----	----	----	-----	98.79	----	-----	100.00	---

It is noticeable that at least four-fifths of the moisture, and in some cases even more, is driven off during the first half hour, the remaining one-fifth requiring from 16 to 24 hours additional for complete expulsion. The moisture in the acid phosphates is expelled in a shorter time (16—18 hours) than is required for the ammoniates (26 hours), showing that the organic matter in the latter gives up its moisture with considerable reluctance. No definite rule can be laid down as to the amount of moisture expelled in a specified time, as it is entirely dependent on the phosphate itself, the amount of acid used in the preparation, and the condition of the separate particles whether or not they exist in fine state of sub-division. I have observed, however, other things being equal, that for an acid phosphate the smaller the content of Insoluble Phosphoric Acid—indicative of sufficient sulphuric acid in the manufacture—the faster is the moisture expelled and *vice versa*.

The method of the Official Agricultural Chemists elsewhere spoken of in this Journal allows 5 hours as the minimum time for the determination of moisture in commercial fertilizers. By referring to Table II we notice at the five-hour limit only one sample has exceeded 93 per cent. of the total moisture present, and this one is an exceptional case—the majority being under 90 per cent., one as low as 83 per cent., or *a fraction under one-fifth of the total moisture present is not estimated if the heating be stopped at this point.*

I can only add one word in attestation of the perfect drying property of concentrated H_2SO_4 for use in dessicators. Not in a single case with a perfect fitting top did this kind of a dessicator allow the sample to increase in moisture even after it had remained in the dessicator for 93 hours.

H. B. BATTLE.

Laboratory of the N. C. Ag. Exp. Station,
Raleigh, May 15*th*, 1886.

ON THE NEUTRALITY OF STANDARD AMMONIUM CITRATE FOR THE DETERMINATION OF REVERTED PHOSPHORIC ACID.

H. B. BATTLE.

The necessity that the Standard Ammonium Citrate Solution (Specific Gravity = 1.09) should be exactly neutral is emphasized in the Washington Method for the determination of Phosphoric Acid as well as in all succeeding methods generally adopted. The method of the Official Agricultural Chemists, adopted first at Atlanta then at Philadelphia and at Washington, lays especial stress on this point.

It is stated by Gladding (American Chem. Journal, VI, p. 3,) that the condition of the Ammonium Citrate, whether neutral, ammoniacal or acid causes varying effect in dissolving the Citrate-Soluble Phosphoric Acid. In a sample of S. C. rock he found—digesting at 65°C for 30 minutes with a neutral solution– 1.35 per cent. P_2O_5 dissolved, with an ammoniacal solution 1.06 per cent. dissolved, and with an acid solution 2.89 per cent., thus showing that the acid solution dissolves 1.54 per cent. P_2O_5 *more* than the neutral solution. The same authority elsewhere writes (Am. Chem. Journ., Vol. IV, p. 138): "To the use of *acid* solutions of citrate, either acid at the beginning of the digestion or becoming acid during its continuance, are probably due more than to any other cause the discrepancies in this analytical process." In view of this fact especial care should be taken in order that the citrate should be exactly neutral at the time of digestion.

Yet, and I believe it is not generally known, the Ammonium Citrate solution after being neutralized, on standing, gradually becomes acid or slightly so. To prove this I carefully neutralized several solutions, and after the lapse of some days, examined them with reference to their neutrality. The solutions were made as laid down by the Atlanta method, using commercial citric acid, neutralizing first with commercial ammonium carbonate*, then with am-

*NOTE.—I would like to state here that I have found the weights given by the Atlanta method inaccurate. They should be 470 grms. Citric Acid and 370 grms. Am. Carb., using ordinary *commercial* chemicals in both instances, instead of the weights given by the method.

monia, and testing with red and blue litmus papers till the neutral point was reached, finally diluting till the specific gravity was 1.09. After allowing to stand several days, and again testing, it was found that the solutions invariably were more or less acid and required varying amounts of concentrated Ammonium Hydrate (26°B) to again become neutral.

The following results were obtained:

Solutions.	Required in c. c's. of Conc. Am. Hydrate to Neutralize after.							
	3 days	7 days	8 days	11 d'ys	17 d'ys	20 d'ys	26 d'ys	30 d'ys
1. 2276 c. c. 1.0938 S. G.	------	10.50						
2. 2515 c. c. 1.09152 S.G.	------	------	14.50	0				
3. 2162 c. c. 1.0918 S. G.	------	------	------	------	19.00	0		
4. 2512 c. c. 1.0920 S. G.	------	------	19.50	0	0	0		
5. 2442 c. c. 1.0916 S. G.	------	------	------	------	------	------	18.50	0
6. 2440 c. c. 1.0916 S. G.	9.00	------	------	------	------	11.50	0	

The amounts of ammonia added cannot be expected to be entirely accurate on account of the difficulties met with in neutralizing such large amounts of solution. It will be seen that about 8 days after preparation the amount of ammonia required is the greatest, nor does this appear to be increased after standing a longer time.

The results reached, while not strictly accurate, show conclusively (1), that the citrate solution should not be used after standing except after it has been again neutralized, and, (2), when this re-neutralization has been done 10 days after preparation the solution can be used with impunity thereafter.

Considering these facts would it not be advisable to follow the plan of preparing a slightly alkaline solution instead of a neutral one?

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Raleigh, March 20th, 1886.

OCTYLBENZOL.

E. A. von SCHWEINITZ.

With regard to the discussion over the constitution of Thiophen, it is of interest to prove whether two compounds, formed by introducing two different substituting groups in inverted order, e. g., methyloctyl thiophen and octylmethyl thiophen, would show the same characteristics.

To settle this question it was first necessary to prepare octyl thiophen, which can easily be done by following V. Meyer and H. Kreis' description of the preparation of the homologues of thiophen. The change of this into the monois-octylthiophen and then into the octylmethylthiophen should yield one of the compounds in question and the introduction of the octyl group into thiotolen should give the other. According to previous researches into the position of the iodine in the thiophen group, the two substituting groups have the β-position. The question whether the two compounds are identical must be settled by an accurate comparison of the two.

Whilst engaged upon this question it was observed that no compound corresponding to octylthiophen was known in the benzol series, though isomers and nearly allied bodies occur. Dibutylbenzol has been described by Goldschmidt (Ber. d. deutsch. Chem. Ges. XV, 1067), obtained by the action of butylalcohol on benzol in the presence of zinc chloride and Beran (Ber XVIII, 131) obtained by the action of octylalcohol on anilin the amido derivative of octylbenzol. I have found that octylbenzol can easily be prepared by the method of Fittig, which, according to V. Meyer, succeeds with all bodies having a normal side chain, and the larger the molecule the better.

It seemed advisable to prepare and study this octylbenzol before going on with the preparation of octylthiophen.

PREPARATION OF OCTYLBENZOL.

The preparation of the octylbenzol was carried out in accordance with the direction of Fittig (Ann. Chem. Pharm. 144, 278), 24 g. Brombenzol, 31 g. normal octyl bromide, 11 g. sodium and the double volume of waterfree ether were used. The octyl bromide was prepared by the action of bromine and phosphorus on octylalcohol after the method of Zincke (Ann. Chem. Pharm. 152, 5).

The reaction soon set in. The mixture was allowed to stand over night, the ether was distilled off on a waterbath and then the product of the reaction driven over by a gentle heat. The product obtained in this way gave on fractionating a colorless oil with a sweet taste and smell and the boiling point 261–263° (uncorr:). This remained liquid at 0°C. Above 266° a yellow oil distilled over which agreed with Lincke's description of Dioctyl. There was also a small amount of oil boiling by 315°. The yield of octylbenzol amounted to 15 g.

ANALYSIS.—0.1440 g. of the substance gave on combustion with copper oxide 0.4653 g. Co_2, equivalent to 0.1269 g. Carbon, and 0.1579 g. H_2o, equivalent to 0.01754 g. Hydrogen.

Calculated for $C_8H_{17}.C_6H_5$		Found.
C	88.04	88.12
H	11.96	12.18

Determination of specific gravity:

Wt. of pyknometer = 0.8187 g.; wt. pyk. + octylbenzol = 1.5110 g.; wt. pyk. + water = 1.6340 g. Hence sp. gr. octylbenzol = 0.849 (water at 15°).

To detect the benzol group in this body I boiled for several days 1 g. octylbenzol with potassium bichromate and sulphuric acid, using a flask and inverted cooler. The hydrocarbon was attacked with great difficulty. The product of the reaction exhausted with ether yielded an acid which gave, after repeated sublimation the melting point of Benzoic acid (120°). It was present however only in small amount.

Preparation of Octylmonobrombenzol.—2 g. octylbenzol were shaken with the calculated amount of strong bromine water and warmed a short time over the water bath. The mixture was then washed with alcoholic potash and poured into water. Thereupon a heavy liquid separated which yielded on fractionating a clear yellow oil boiling between 285°—290°. This is easily soluble in ether and does not solidify at 0°.

In determining bromine 0.1584 g. of the substance yielded 0.1098 g. silver bromide, equivalent to 0.046719 g. bromine; calculated for $C_8H_{17}.C_6H_4$. Br. sp., p. c. Br. = 29.70, found p. c. Br. = 29.43.

Preparation of octylbenzol sulphonic acid.—2 g octylbenzol were shaken with fuming sulphuric acid and the product poured into water. On treatment with lead carbonate the lead salt of the acid

was formed and from that after saturation with sulphuretted hydrogen and evaporation of the filtrate the free acid was obtained as a thick syrup-like liquid with strong acid properties. To further characterize the acid the following salts were prepared:

Lead octylbenzol sulphonate.—This salt was gotten by treating the aqueous solution of the acid with pure lead carbonate. It crystallized in small microscopic needles which were easily soluble in water.

ANALYSIS—0.1715 g. of the salt yielded by 130° 0.0121 g. water; 0.1715 g. of the salt yielded 0.0640 g. lead sulphate, equivalent to 0.04373 g. lead.

Calculated for $(C_8H_{17}C_6H_4SO_3)_2$ Pb+3H_2O		Found.
Pb	25.78	25.50
H_2O	7.25	7.08

Barium octylbenzol sulphonate.—This salt was prepared in the same way as the lead salt. Under the microscope it showed thin plates which were easily soluble in water:

ANALYSIS.—0.0987 g. of the salt gave by 130° 0.0023 g. water 0.0987 g. of the salt gave 0.0337 g. barium sulphate, equivalent to 0.01983 g. barium.

Calculated for $(C_8H_{17}C_6H_4SO_3)_2$ Ba+H_2O		Found
Ba	19.78	20.09
H_2O	2.59	2.33

Silver octylbenzol sulphonate.—This salt was prepared from the freshly precipitated silver oxide and the aqueous solution of the acid. Under the microscope it showed thin plates which were easily soluble in water.

ANALYSIS.—0.1009 g. of the salt gave by 130° 0.0046 g. water 0.1009 g. of the salt gave 0.0363 g. silver chloride, equivalent to 0.02736 g. silver.

Calculated for $C_8H_{17}C_6H_4SO_3$ Ag + H_2O		Found.
Ag	27.41	27.11
H_2O	4.61	4.59

OCTYL DERIVATIONS OF THIOPHEN.

Preparation of octylthiophen.—This was prepared after the method described for octylbenzol. 50 g. thiophen iodide, 50 g. octyl bromide, and 22 g. sodium, together with twice the volume of ether, were used. After the reaction the ether was distilled off on a water bath and the remaining products of the reaction distilled at a gentle heat. By fractionating the product obtained in this way, an oil, boiling at 259—263°, was gotten which had the same smell and taste as octylbenzol. The analysis revealed only 12 p. c. sulphur, whereas the calculated percentage is 16 32 p. c. Evidently the oil contained dioctyl and it is difficult to effect a separation. Still after several fractionatings of another portion of the crude product an oil was obtained which boiled at 257—259°, and an analysis of this proved it to be pure octylthiophen. The oil is easily soluble in ether and gave with phenanthrenchinon and sulphuric acid the Laubenheimer reaction.

ANALYSIS.—0.1363 g. of the substance gave 0.1583 g. $BaSO_4$ corresponding to 0.02174 g. S.

Calculated for $C_8H_{17}C_4H_3S$ — 16.32 p. c.; found 15.95 p. c.

Determination of Specific Gravity.—Weight of the substance in picnometer 0.0820 g.; weight of water 0.1010; Specific Gravity (water 20.5°) = 0.8118

Preparation of octylmonobromthiophen.—This is prepared by shaking octylthiophen with bromine water (1 mol.), washing the product with alcoholic potash and water and then fractionating. In this way an oil was gotten which boils at 285–290°. It is easily soluble in ether, insoluble in water and solidifies to scales at 5°.

ANALYSIS.—0.0935 g. yielded 0.06411 g. AgBr, corresponding to 0.0272 g. Br. Hence found p. c. Br = 29.19; calculated for $C_4H_2S.C_8H_{17}.Br$ p. c. Br = 29.09,

Preparation of octylmono iod-thiophen.—The usual method making use of iodine and mercuric oxide was pursued. 10 g. octylthiophen, diluted with an equal volume of ligroin (90 p. c.), 10 g. iodine and 11 g. mercuric oxide were used. The reaction proceeded very slowly in the cold and was therefore hastened by a gentle warming on the water-bath. After filtering off the mercuric iodide which

formed, the impure product was distilled with steam. The residue in the flask was then exhausted with ether, the ethereal solution treated with animal charcoal and dried. After evaporation of the ether a yellow oil remained. It was easily soluble in ether and solidifies at 0°. It cannot be distilled however without decomposition. As bye-product a few yellow crystals, probably the diiodide, were formed. In preparing iodthiophen a large amount of diiodthiophen is always obtained as bye-product. That the analogous compound appears in this case only in traces speaks for the difficulty of substituting the hydrogen atom in the γ position of the thiophen.

ANALYSIS.- 0.1617 g. substance gave 0.1184 g. AgI, corresponding to 0.06351 g. I. and 0.1120 g. $BaSO_4$ corresponding to 0.01538 g. S. Hence p. c. I. =39.27; p. c. S = 9.54; calculated for $C_4H_2S.\ C_8H_{17}I$. p. c. I =39.44; p. c. S =9.94.

Specific Gravity Determination.—Weight of Iodthiophen in picnometer = 0.1380, weight of water = 0.1094. Specific Gravity (water at 20°) = 1.2614.

An attempt to prepare an octylthiophen sulphonic acid by treatment of the octylthiophen with pyrosulphuric acid did not succeed. The reaction was accompanied by a blackening and the mixture yielded, after treatment in the usual way, an acid whose barium salt was identical with the β-thiophensulphonate of barium described by Jaekel (Berichte der d. Chem. Ges. XIX, 184). The melting point of the amide of this acide was 211.5°. It seems therefore that a great excess of pyrosulphuric acid brings about a substitution of the octyl group by the sulpho group.

Preparation of octylacetothienon.—Following the directions of Peter (Ber. der d. Chem. Ges. XVII, 2643) 10 g. octylthiophen, diluted with ten times its volume of ligroin, 5 g. acetylchloride and a sufficient amount of aluminium chloride were used. After distilling the products of the reaction with steam and fractionating an oil was obtained boiling at 350—355° and having a fruity odor.

ANALYSIS.—0.1768 g. substance gave 0.1680 g. $BaSO_4$ corresponding to 0.0230 g. S. Hence p. c. S = 13.04; calculated for $C_4H_2S.\ CO.CH_3C_8H_{17}$ p. c. S =13.44.

An alcoholic solution of the ketone treated with hydroxylamine

hydrochloride and soda solution yielded an oil which solidified in the cold to white crystals. By oxidation of the ketone it was hoped that an octylthiophen-mono-carbonic acid would be obtained. An octylthiophendicarbonic acid however was obtained. This suprising result is to be explained as follows: Since the octylacetthienon distills difficultly with steam the distillation was stopped after some hours. The residue in the flask which was considered identical with the distillate was used for oxidation, after purification with animal charcoal. This consisted for the most part of octyldiacethienon $C_4HS.C_8H_{17}.(CO-CH_3).(CO-CH_3)$.

To verify this some octyldiacetothienon was prepared pure from 10 g. octylthiophen (75 p. c.), 10 g. acetylchloride and a sufficient amount of aluminium chloride. After distilling with steam in order to drive out dioctyl and other products the residue was exhausted with ether purified by charcoal and the ether solution dried. After evaporation of the ether there remained a yellow, thick syrup-like liquid which solidified on being strongly cooled. It was easily soluble in alcohol but not in water.

ANALYSIS.—0.1292 g. substance gave 0.1068 g. $BaSO_4$ corresponding to 0.01466 g. S., or p. c. S = 11.35; calculated for $C_8H_{17}.C_4HS.(CH_3CO)_2$ p. c. S = 11.42.

An alcoholic solution of the ketone treated with hydroxylamine hydrochloride and sodium hydroxide yielded a nitrogenous product which crystallized from alcohol. The crystals melted by 58°.

Preparation of octylthiophen dicarbonic acid.—The oxidation of octyldiacetothienon was carried out with potassium permanganate in the usual manner. 15 g. ketone, 40 g. potassium permanganate, in 2 p. c. solution, and 40 g. potassium hydroxide were used. After standing twelve hours and gently warming on the water-bath the reaction was completed. The manganese dioxide was then filtered off and the filtrate acidified and exhausted with ether. On evaporating the ether a solid with a disagreeable odor was left. Warmed with a little water on the bath this bad odor was lost. The ether solution of the residue, purified by animal charcoal, yielded a yellowish, white substance with a fatty feel and strongly acid nature. This acid showed as crystalline needles under the microscope, melted at 185°, with partial charring, is nearly insoluble in cold water and soluble in hot water.

ANALYSIS.—0.1456 g. substance gave 0.1159 g. barium sulphate or 0.01591 g. sulphur. Hence p. c. S = 10.91.

Calculated for $C_8H_{17}C_4HS.(COOH)_2$ p. c. S = 11.26.

Barium octylthiophendicarbonate.—The salt was prepared from an aqueous solution of the acid and pure barium carbonate. It is easily soluble in hot water and crystallizes in needles.

Calculated for $C_{14}H_{18}SO_4$ Ba. 1½H_2O		Found.
Ba	30.71	30.89
H_2O	5.99	5.97

Copper octylthiophendicarbonate.—The ammonium salt of the acid gave with a solution of copper sulphate a yellowish green crystalline precipitate, difficultly soluble in cold water, easily soluble in hot.

Calculated for $C_{14}H_{18}SO_4$ Cu. 2½ H_2O		Found.
Cu	16.13	16.37
H_2O	12.40	12.66

Silver octylthiophendicarbonate.—The ammonium salt causes in a solution of silver nitrate a yellow crystalline precipitate, which is difficultly soluble in hot water. It soon changes to red-brown in the light.

Calculated for $C_{14}H_{18}SO_4$ Ag_2. 3H_2O		Found.
Ag	39.40	39.36
H_2O	9.77	9.71

A solution of the ammonium salt gave with a concentrated solution of zinc sulphate a yellowish white precipitate. With manganese sulphate solution a precipitate formed, insoluble in cold water, difficultly soluble in hot water. With ferric chloride a yellow precipitate was gotten.

Preparation of methyloctylthiophen.—To solve the problem with which I started, I proceeded as follows: This preparation took place in accordance with the directions of Fittig. 27 g. iodthiotolen (ββ) 25 g. octylbromide, 5 g. sodium and double the volume of ether were used. The reaction soon commenced and seemed to be completed in about twelve hours. Fractionation of the resulting product yielded an oil boiling at 270—275°. In the cold it solidified to crystals. These were pressed and analyzed:

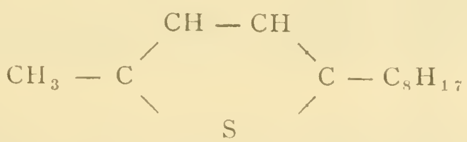
ANALYSIS.—0.1229 g. substance yielded 0.500 g. barium sulphate or 0.00686 g. sulphate. Hence p. c. sulphur = 5.68; calculated for $C_{13}H_{22}S$ p. c. sulphur = 15.24.

From this it was assumed that the wished-for substance was rendered impure by dioctyl. To confirm this the mono-brom-compound of the substance was prepared with bromine water in the usual way and the unaltered dioctyl removed by distillation. A clear yellow liquid was then gotten which solidified to crystals in the cold. These melted by 20°. A bromine analysis gave 27.86 p. c., calculated for $C_{13}H_{21}$ S Br 27.75. Some of this bromine compound was dissolved in alcohol and treated with sodium amalgam. After extraction with ether and purification a clear liquid was gotten which solidified to crystals in the cold. These melted at 10°.

Preparation of octylmethylthiophen.—The preparation was similar to that of methyloctylthiophen. 8 g. iodoctylthiophen, 5 g. methyl iodide and 2.5 g. sodium, with double the volume of ether were used. The reaction seemed complete after standing five days. The ether was then distilled off and the remainder distilled by gentle heat. This was further fractionated. A colorless oil was thus gotten. It boiled at 270° and solidifies in the cold to crystals which melt at 10°. A sulphur determination gave p. c. S = 15.58—calculated for $C_{13}H_{22}S$ p. c. S =15.24.

To compare this better with methyloctylthiophen, this too was brominated. Crystals were thus obtained melting at 20°. A bromine determination gave p. c. Br = 27.96—calculated for $C_{13}H_{21}S$ Br. p. c. Br = 27.75. The two compounds methyloctylthiophen and octylmethylthiophen are therefore to be looked upon as identical.

In accordance with what has hitherto been communicated as to the structure of the thiophen compounds, the following formula must be ascribed to them:



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THE CIGARETTE BEETLE.

(*Lasioderma serricorne, Fab.*)

BY G. F. ATKINSON.

This beetle sometimes proves very troublesome to manufacturers and dealers in cigarettes and smoking tobacco. While it feeds upon, and breeds in, dry tobacco in almost any form, it seems to have a preference for cigarettes.

Several years ago it proved very annoying in some warehouses in Philadelphia. I learn from Prof. C. V. Riley, of Washington, that it has also caused a great deal of trouble in warehouses in Baltimore; that it is pretty generally distributed in all parts of the world, and feeds with relish upon cayenne pepper, spices and nearly all pungent substances. It has also been reported as a "drugstore pest," feeding on capsicum.[1]

After the pest has once taken up its abode in a factory there are several means by which it may find its way into the manufactured goods. It may be present in the leaf tobacco. When this is not thoroughly steamed preparatory to "trimming" and "cutting," the young larvæ or eggs may pass through the process of manufacture unharmed, and be stored with the goods. During the process of drying the tobacco and making the cigarettes the female may deposit the eggs on the tobacco which remains unprotected during the night. Even after the cigarettes are manufactured and stored the beetle can enter the boxes and deposit the eggs, as the boxes are usually rude in structure with openings sufficiently large to permit her entrance.

Once in the cigarette the larva feeds until full grown, when it usually leaves the cigarette to seek a place to pupate. In doing this it more frequently cuts through the paper wrapper, thus perforating the cigarette and destroying the "draught."

During the present year my attention was called to the injuries of this insect, and as its natural history has not been fully worked out I undertook investigations leading to its determination.

[1]American Entomologist, Vol. I, p. 99 and 147.

NATURAL HISTORY.

Number of Annual Generations.—There are at least two generations each year in this latitude, though the periods of transformation do not seem to be very well marked, as variations in the length of the larval stage cause an overlapping of the broods. The extremes of variation may extend so as to make it possible that some transformations are taking place at all times of the year, where the temperature of the manufactory is such as to permit the activity of the insect in some of the rooms. I have seen the beetles in the act of copulation in January, and during the periods when the majority of the transformations are taking place the larvæ may be found in very different stages of development.

One of these periods occurs during the month of June. June 28 I placed beetles in the act of copulation in small phials and added a minute quantity of prepared cigarette tobacco. In from two to three days the eggs were deposited.

Egg.—The egg is opaque, white, elongate, oval, or elliptical, .4^{mm} long by .22^{mm} in diameter in the broadest part. Micropyles .04^{mm} long covering one end. The number of eggs deposited by the beetles observed varied from 40 to 75. In the phials in which was placed a few threads of prepared cigarette tobacco the eggs were scattered, some upon the glass and a few on the tobacco. In the phials containing bits of leaf tobacco the eggs were laid in irregular patches between the portion of a fold. In about 11 days the egg hatches.

Length of Larval Stage.—The larval stage at this season averages from 60 to 70 days. Eggs which were deposited June 30 hatched July 11, and some larvæ constructed cocoons September 11. From 5 to 7 days afterward they transform to pupæ. The larva is whitish and covered with very slender white hairs. It measures from 4^{mm} to 4½^{mm} in length.

Cocoon.—The cocoon is of a papery texture, formed of finely divided particles of material which is near at hand, cemented together with viscid liquid. In the case of cigarettes the larva usually leaves the cigarette and makes the cocoon against the paper package, or in some of its foldings, or in a corner of the box. In this case the cocoon is made chiefly of paper. In leaf tobacco the larva usually remains among the foldings of the leaves and constructs the cocoon from tobacco. It does not use the hairs from the body in the construction of the cocoon.

The beetle is of a brown color, and about 2¾^{mm} long. It has a

habit when disturbed of feigning death. It is said to be nocturnal in its habits; but it is also partially diurnal, as many times I have seen them in copula, and they have frequently been observed flying about the factory during the day.

Soon after pairing the male dies, and the female does not live long after she has finished depositing her eggs.

Second Annual Generation.—The second period of transformation into the adult state occurs about the last of August and during the month of September. Those which I bred from eggs deposited June 30 were transforming from the middle of September to the end of the first week in October. September 28 I examined some smoking tobacco which was put up July 6. The condition of the insect was about the same as of those which I reared. This would indicate that the eggs were deposited on the tobacco at the time of its preparation for placing in packages. During the month of September, with some variations, seems to be the beginning of the second annual generation. Allowing the same time for larval development as in the case of the summer generation the larvæ would be ready in November and December for constructing the cocoons preparatory to pupating. However, as the investigations have been in progress only a little more than half a year, I have not had an opportunity of studying the stages of the second generation. But I judge from the condition of things as I found them in the factory in January that the earliest of the brood would construct cocoons in the latter part of the fall or early winter, and in rooms where the temperature was favorable would pupate and transform into the adult. If the temperature of the room is too low for the functional activity of the metamorphic state, the insect would remain in the larval state during the winter. From January 11 I kept a larva in its cocoon for three months before pupating.

The greater number of individuals of the second generation would probably pass the winter in a torpid state, and feed during the spring sometime before pupating. It may be possible that under some conditions there are three annual generations, but the indications thus far seem to favor their being in general only two. A continuation of the present investigations is necessary to determine this point.

REMEDIES.

Precautionary Measures.—The precautions usually recommended are as follows: The steaming of the leaf tobacco should be thorough

to insure the destruction of all eggs and larvæ which may infest it. Cut tobacco should be kept in tightly closed boxes until used. All cigarettes should be packed at the close of the day's work, or closely covered with flannel blankets. As the beetle is said to be a night flier, windows and doors of the warehouse should be kept closed at night. The walls of the building should be kept freshly white-washed, and no dust heaps allowed to accumulate.

For the purpose of determining the degree of heat to which the insect would be subjected during the process of steaming, I had tests made with the thermometer under three different conditions: *First*, with the bulb of the thermometer between the hands of tobacco; *Second*, with the bulb of the thermometer in among the leaves of the hand; *Third*, the bulb of the thermometer bound with tobacco as tightly as the portion of the hand which contains the band. Ten tests were made under each condition. The following table exhibits the results:

	First condition.	Second condition.	Third condition.
No. of Test.	Degrees Fahr.	Degrees Fahr.	Degrees Fahr.
1	194	178	170
2	200	164	200
3	190	169	200
4	200	170	180
5	210	188	200
6	200	190	180
7	212	184	180
8	202	172	176
9	192	160	178
10	204	196	174
Highest,	212	196	200
Lowest,	190	160	170
Average,	200.4	177.1	183.8

The above tests were made on tobacco of a second grade and the steam was allowed to remain on longer than would answer on bright grades of tobacco. But examining bright grades of tobacco just as it came from the steam chest I think there can be no doubt that the steaming will kill the larvæ and eggs if the tobacco is evenly steamed and subjected to the heat for as long a time as will answer for the preservation of the quality of the leaf. Where the sides of the steam chest are low I have noticed that the ends of the "hands" of tobacco often project over the edge and these portions are not properly heated. In turning the tobacco if care was used to place

these ends where they would come in the presence of the full power of the heat there would be little danger of the insect passing through unharmed. It would be safer, however, to have the edges of the steam chest high enough so that when covered with the blanket all portions of the tobacco would be subjected to a like grade of heat.

After the tobacco is cut, the process of drying occupies so much time that there is danger the beetle will deposit eggs on it. This can be avoided by a substantial dry-house, separate from the factory, which can be kept very clean and tightly closed at night. By using care as to the condition of tobacco which is placed in the dry house, it can be kept safe during this period. Where trouble is apprehended quantities of cut tobacco should not be kept on hand unless stored in safe boxes. The better way would probably be to fill an order a little late than with material which is liable to be infested.

During the season when the beetle is flying about the factory, each operator in the cigarette room should be provided with a neat and closely fitting box which would hold approximately sufficient tobacco for the day's work. What remains at the close of the day each operator can put in his box, and thus prevent the beetle from depositing eggs on the portion which remains over night. The manager of this department could in a short time see that the tobacco was properly protected for the night.

For storing the cigarettes boxes of convenient size, which shut very closely, could be used, and thus the danger of the beetle entering be averted. By ridding the factory of infested stock, removing such material as would afford a breeding place, and adopting some such precautions as suggested, it is reasonable to suppose the pests could be controlled.

From the knowledge of the natural history of the beetle already determined quite an important result is reached. In case of goods manufactured during the summer, if it is feared the insect is present, they may be stored for 90 days, when if no signs of the presence of the insect are detected, it would be safe to ship the goods. This would also afford a protection to the manufacturer. If the work of the beetle was not evident within 90 days from the time the goods left the factory the manufacturers would be relieved of the responsibility.

Fumigation as a Remedy.—From experiments, both on a large and small scale, it has been found that the insect can be destroyed by treating with the fumes of bisulphide of carbon without in the least affecting the flavor or appearance of the cigarette. As this

substance is very volatile it is an easy matter to apply the fumes, having for this purpose a large box well made to prevent the escape of the fumes. In this the cigarette boxes could be placed, and also a small open vessel containing the bisulphide of carbon. Where goods are already damaged the assorting which would be necessary to remove the perforated cigarettes, together with the trouble of applying the remedy, might outweigh the advantage to be gained.

But in the case of recently manufactured goods in which the eggs were deposited at time of manufacture, if they are stored in closely fitting boxes, the fumes could be applied to each box about 20 days after manufacturing. As the egg hatches in about 11 days after being deposited the larvæ would be very small, and constitute no greater impurity in the cigarettes than what must undoubtedly enter from various other sources. As this is a common remedy for grain weevil, an insect affcting grains which are used for bread stuffs, there can be no danger in its use. Cigarettes have been smoked within ten minutes from the time they were removed from the fumes. While it is perfectly safe to apply this as a remedy when it seems necessary, and other gentlemen who have had practical experience in such matters also recommend it, there are some who do not regard it as a pleasant remedy. On the whole, as the precautionary measures must be adopted sooner or later in order to get rid of the pest, it might, perhaps, be as well to rely solely on them.

PARASITES.

There is a small chalcid fly which enters the boxes sometimes and destroys the larvæ. These I discovered September 28. They would probably never prove to be of any considerable economic importance owing to the difficulty attending their reaching the host.

NOTES ON THE ORCHARD SCOLYTUS.

(*Scolytus rugulosus. Ratz.*)

By G. F. ATKINSON.

Some interesting things in the habits of the orchard scolytus have come under my observation during the past year. This is a minute beetle which infests peach, plum and cherry trees[1], and has done considerable damage to fruit growers recently in this country, and notably so in the South.

The weight of opinion seems to favor the view that the beetle attacks only diseased trees. It sometimes attempts to bore into healthy trees for the purpose of depositing eggs, but is driven out by the exudation of the gum. I have seen sound limbs of healthy peach trees badly punctured in this way, but no evidence of eggs being deposited or of the larvæ at work. I am led to believe that in some cases this may lead to a diseased condition of the tree and thus afford suitable material for the beetle to work upon.

The number of annual generations in this latitude is probably two. I have noticed that the late spring (May) and early autumn (Sept.) are two periods during which numbers of beetles excavate the galleries to deposit the eggs.

The female beetle seems to exhibit great maternal affection. The galleries in which the eggs are deposited are from ½ to ¾ inch in length. The opening is just the size of the beetle, but the gallery a very little larger in diameter. When the eggs are deposited the female retreats to the entrance and remains here with the posterior part of the body even with the outer bark of the tree When touched she will crawl in a short distance, and return when the disturbance ceases. She remains here night and day guarding her eggs and young with a maternal fondness rarely seen. I have ob-

[1]Scolytus rugulosus in branches of Pear Trees which were killed by Pear Blight. Can. Ent., Vol. 16, p. 161, by Dr. H. A. Hagen

Peach Yellows. Houghton Farm. Exp. Dept. Appendix to Series III, No. 2. D. P. Penhallow.

Minute Borers in Cherry, Peach and Plum Trees. Prof. C. V. Riley in Am. Entomologist, Vol. III, p. 298.

Georgia Crop Report for August, 1884, p. 16.

served several which lived for two months always at the post of duty. Even in death they remain blocking the entrance, and it is a very common thing to find them attacked by a fungus and their bodies wedging up the entrance firmly.

Eichoff speaks briefly of this habit in Scolytus[1], where he says, "das Weibchen meist im Gange selbst stirbt, entweder am äussersten ende seines Brutganges oder (bei den einweibig lebenden Arten) wie bei Scolytus (Eccoptogaster) nachdem es sich an die Eingangsöffnung begeben und diese zum Schutz gegen äussere Witterungseinflüsse und vor eindringenden Feinden, den After nach aussen gekehrt luft verachlassen hat."

From specimens in the laboratory I bred two parasites, which were determined by Mr. L. O. Howard, of Washington, as follows: *Chiropachys colon.* Linn. And *Eupelmus* sp. The Chiropachys, Mr. Howard tells me, has been bred from the larvæ in the Department at Washington. When these parasites transform into the adult they escape by cutting a cylindrical hole through the bark. Some of these holes are as small as .25 ^{mm} in diameter. From an examination of infested branches of peach trees I find that the parasite is quite abundant, and it undoubtedly is quite effective in checking the multiplication of the Scolytus.

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[1]Die Europäischen Borkenkäfer, 1881.

NOTE.—I wish to acknowledge my indebtedness to Prof. C. V. Riley, of Washington, for the use of some literature from the Department; and to Mr. E. A. Schwartz for a work from his private library.

WILMINGTON FLORA; A LIST OF PLANTS GROWING ABOUT WILMINGTON, N. C., WITH DATE OF FLOWERING, WITH A MAP OF NEW HANOVER COUNTY.

THOMAS F. WOOD AND GERALD McCARTHY.

INTRODUCTION.

The growing interest in botany during the last ten years has created the necessity for a manual for local work in botany, especially as regards the Cape Fear region.

The pamphlet, published by Dr. Curtis in 1832, has long since become a rarity, and was not up to the recent date as regards the newer discoveries, and abounded in old synonyms. An attempt was first made to rewrite this catalogue, substituting the accepted synonyms of to-day, but it was found best to re-write it entire. This pamphlet, therefore, has for its basis the work of Dr. Curtis. To it has been added all the plants which he subsequently added in his catalogue of the plants of the State, and the few other plants which have been added since that work was issued.

We have given the date of flowering of plants, founded as much on personal observation as possible, but still we feel that this part of the work can be much improved. For the sake of many beginners, we have also added the color of flowers, knowing, of course, that to the scientific botanist, such a slight aid would be so imperfect as to be of little use to him; but, for beginners, who are puzzling over plant analyses for the first time, such a slight knowledge as the color of a flower would often be of help. Furthermore, amateur botanists, of whom there is an increasing number all over the State, appreciate such slight aids, and for these considerations we think the trouble has been well spent.

We have added a map of the Cape Fear region which is accurately drawn to a scale (one mile to ½ inch), and will be found valuable to botanists and others. The basis of this map was one drawn by Capt. W. H. James, of the Confederate States Engineers, after a complete topographical survey during the war. Corrections and additions have been made to date, as nearly as possible, excepting

that the names of the proprietors of farms have been in many instances unaltered. It is easy enough, with this map, to go to any locality in the county, and botanists and amateurs, seeking the quite numerous local plants of this favored region, could hardly go amiss.

Dr. Curtis' original catalogue enumerated species found within a radius of two miles of Wilmington; but we have extended our search over the entire county, even extending to what is now a part of Pender county, especially including the region of Rocky Point, and of Smithville and Smith's Island, and the part of Brunswick county immediately adjacent to Wilmington.

"Wilmington is situated in latitude 34° 17′, and longitude 78° 10′, about thirty miles from the mouth of the Cape Fear river, on which it stands, and eight miles from the sea, in an easterly direction. Its precise elevation above the ocean I have not learned,* but it is so small as to deserve little or no consideration in regard to botanical geography. Indeed much of the lowland in the vicinity is but little above the level of the ocean. The climate may be pretty well determined from the following table of temperature, made from observations taken in 1832. The thermometer was placed in the shade on the north side of a house. Observations were taken six times a day from 8 and 9 o'clock A. M. to 11 P. M. Fractions omitted:

	Jan.	Feb.	Mar	Apl.	May	Ju'e	July	Aug	Sept	Oct.	Nov	Dec.
Maximum	72	75	80	87	....	97	86	83	85	82	77	68
Minimum	18	32	25	42	....	60	68	66	63	40	36	27
Medium..........	46	55	56	65	....	77	72	79	75	66	57	50
Rainy days	4	8	4	8	....	5	9	14	12	4	6	5

†TEMPERATURE FOR YEAR 1885.

	Jan.	Feb.	Mar	Apl.	May	Ju'e	July	Aug	Sept	Oct.	Nov	Dec.
Maximum	74	70	71	84	88	93	94	94	89	81	80	71
Minimum	23	20	26	37	51	58	62	60	52	42	30	27
Mean	49	45	49	62	70	76	81	80	73	62	55	50
Rainy days	17	9	11	6	14	7	15	15	7	10	10	9

*The elevation of Wilmington is twenty-five feet above sea level.

†This report was obtained from the U. S. Signal Service officer at Wilmington. The number of rainy days includes all days on which as much as .01 of an inch fell, which probably accounts for the excess of rainy days in 1885.

I have not materials for forming an accurate Floral Calendar for Wilmington, but the following notices show the flowering time of a few plants in the spring of 1832:

Daffodils in flower,	Feb. 1	Red Cedar and Elm	Feb. 1
Red Maple	" 8	Jonquils	" 10
Peach and Plum	" 12	Cercis Canadensis	" 26
Flowering Almond	" 26	Epigæa repens	" 26
Phlox subulata	" 27	Luzula Campestris	" 27
Vaccinium corymbosum	March 1	Viola cucullata and lanceolata	March 6
Cardamine Virginica	" 6	Bayberry (Myrica)	" 10
Thlaspi bursa-pastoris	" 10		

In 1831, Daffodils blossomed January 1st, and the White Hyacinth at Christmas, which is about their usual period of flowering." —*Moses A. Curtis, A. M., in " Catalogue of Plants Growing Spontaneously Around Wilmington.*"

The following list of plants, with their dates of flowering in 1885, is taken from the note book of Miss Hettie E. Watson, Secretary of " The Curtis Club," of Wilmington:

Alder,	February	1	Cydonia Japonica,	February	20
Chickweed	"	2	Pyxidanthera barbulata,	"	26
Blue Violet,	"	2	Short Leaf Pine stam,	"	26
White Violet,	"	3	Short Leaf Pine pistillate	"	26
Arbutus,	"	3	Oxalis yellow,	March	7
Jessamine, yellow	"	3	Water cress,	"	7
Huckleberry (*Vaccinium corymbosum.*)	"	3	Pepper grass (*Lepidium Virginicum.*	"	23
Chrysogonum Virginianum	"	3	Nasturtium,	"	23
Bartonia verna,	"	3	Willow catkin, sterile	"	26
Cedar,	"	5	Willow fertile,	"	26
Long Leaf Pine stam,	"	5	Strawberry, yellow, (*Fragaria Indica,*)	"	26
Long Leaf Pine pistillate,	"	16	Strawberry, white, (*F. Virginiana*),	"	26
Schallott,	"	16	Peach,	"	26
Gill,	"	16	Sassafras,	"	27
Red bud,	"	16	Golden Club, (*Orontium*),	"	28
Cypress,	"	16	Rubus trivialis,	April	1
Red Maple,	"	16	Euphorbia,	"	1
Red Cedar,	"	16	Willow Oak, (*Quercus Phellos,*	"	4
Elm,	"	16			
Prunus Carolinianum,	"	19			
Mistletoe,	"	19			

Scrubby Oak, (*Q. Catesbœi*)	April	4
Live Oak, (*Q. Virens*)	"	4
Water Oak, (*Q. Aquatica*)	"	4
Sorrel wood, (*Oxydendrum arboreum*)	"	4
Collard,	"	4
Blood root, (*Sanguinaria Canadensis*)	"	4
Ranunculus acris,	"	5
Rubus villosus,	"	5
Blue Plum,	"	5
Azalea nudiflora,	"	5
Woodbine, (*Lonicera sempervirens*)	"	6
Pear,	"	6
Low Laurel, (*Kalmia angustifolia*)	"	6
Cratægus,	"	7
Euphorbia commutata,	"	7
White Clover,	"	7
Ilex glabra,	"	7
Linaria Canadensis,	"	7
Pontederia,	"	9
Sweet Gum,	"	9
Horse Radish,	"	9
Mulberry,	"	9
Myrtle, pistillate,	"	9
Myrtle, stam,	"	9
Iris verna,	"	9
Elder, small,	"	9
Turnip,	"	10
Buckeye,	"	10
Dogwood,	"	10
Wild Olive,	"	10
Quince,	"	10
Crab Apple,	"	10
Horse Apple,	"	10
Apricot,	"	10
Running Huckleberry, (*Vaccinium crassifolium*)	"	10
Clematis crispa,	April	11
Cyrilla racemiflora,	"	11
Pinguicula elatior,	"	1
Salix Nigra,	"	19
Paulownia,	"	20
Asarum,	"	20
Sysyrinchium Bermudiana,	"	20
Uvularia,	"	20
Crowfoot,	"	21
Campanula,	"	21
Wistaria,	"	21
Wild Cherry, (*Prunus serotina*),	"	21
Lespedeza,	"	21
Leptocaulis divaricatus,	"	22
Lupine, purple,	"	22
Pea, (English)	"	25
Irish Potatoe,	"	25
Butter wort, (*Pinguicula pumilla*,)	"	25
Rosa Carolina,	"	27
Sarracenia flava,	"	27
Drosera brevifolia,	"	29
Wild phlox,	"	29
Melia azederach,	"	29
Ilex opaca,	"	29
Walnut,	"	29
Chinquapin,	"	29
Tecoma radicans,	"	29
Fox Grape,	"	29
Azalia viscosa, (white)	"	29
Amphicarpæa monoica	"	29
Utricularia,	"	29
Pipe wort,	"	29
Leucanthemum,	"	30
Clover,	"	30
Sparkle berry, (*Vaccinium arboreum*)	"	30
Bay, (*Magnolia glauca*,)	"	30

Of the many valuable ornamental trees Lagerstrœmia Indica (Crepe Myrtle) has long ago been naturalized, attaining the height of 20 feet. Gardenia (Cape Jessamine) is hardy, and is used as a

hedge or border in Oakdale Cemetery, where it fruits occasionally. The Japanese tea plants, distributed by the Agricultural Department from Washington. have been found hardy under the treatment of Mr. Donlan at Oakdale Cemetery, fruiting very freely. The Eucalyptus globulus was thoroughly tried by the gentleman above named, but with the utmost care the hardiest looking young tree was killed by the frost, and the experiment abandoned. The Sabal Palmetto, which has its northern limit at Smith's Island, has been successfully transplanted in three instances in Wilmington as an ornamental tree, much to the surprise of those who had formerly failed after great pains. Its transplantation seems to be as difficult as to transplant the pine. The banana during one favorable season fruited but did not come to full maturity. It is evident that the seasons are too short to expect success with it. The Ailantus is no longer a desirable shade tree, and has been generally made to give place to Elms and Oaks; and we are sorry to say that the Pride of China, one of the handsomest trees introduced among us, is losing popularity. A fine specimen of Negundo aceroides. from an accidental seed dropped in a private garden in the city, shows how kindly this beautiful tree would take to our soil if encouraged by the gardner. In our catalogue we have left out these, or most of them, and mention them here as an indication of the range of temperature.

This catalogue is arranged after the natural orders in Curtis' "Catalogue of Plants of North Carolina." The popular names have been retained as a matter of convenience—sometimes for curiosity.

We have added a list of plants found in the ballast along the river front, used to fill in the wharves of the Railroad Companies. The list is only a small portion of the plants found, but were all identified by Mr. McCarthy up to this time. These plants are from distant parts of the world, and it will be interesting to watch their history. They are mostly weeds, and from similar sources numbers of weeds have escaped into our fields and streets and by-ways. It will be noticed that several of these weeds, since Dr. Curtis' day, have become common in neglected streets and waste places, such as Viper's Bugloss (Echium) and Acanthospermum Xanthioides. Both plants are now stubborn weeds.

Species with names in heavy-face type are believed to be indigenous. Species with names in small capitals are not regarded as indigenous.

A numerical statement of the genera, species and varieties is given at the end of the catalogue.

CATALOGUE.

FLOWERING PLANTS.

DICOTYLEDONS.

RANUNCULACEÆ. (CROWFOOT FAMILY.)

Clematis crispa, Linn. (BLUE JESSAMINE. BLUE BELL.) May and June until October. Flowers pale bluish purple. In three distinct crops.

Virginiana, L. Rocky Point. June. Flowers white.

Viorna, L. Rocky Point. Dr. McRee. May—August. Flowers purple.

Anemone Virginiana, L. (VIRGINIA ANEMONE.) July—September. Flowers obscure white.

Caroliniana Walt. Dr. McRee. March. Flowers white.

Hepatica triloba, Chaix. Dr. McRee. Rocky Roint. February—March. Purple or white.

Thalictrum anemonoides, Michx. (RUE ANEMONE.) April—May. Flowers white.

Cornuti, L.—(MEADOW RUE.) June–August. Flowers white.

Ranunculus abortivus, L. (SMOOTH CROWFOOT.) March—April. Flowers yellow.

BULBOSUS, L. (BUTTERCUPS.) May. Flowers yellow.

repens, L. (CREEPING CROWFOOT.) March and April.

repens var. nitidus, MUHL. Flowers smaller than above.

pusillus, Poir. (DWARF CROWFOOT.) March and April. Flowers minute yellow.

recurvatus, Poir. (*R. Nelsoni, Gray.*) (ROUGH CROWFOOT.) April and May.

parviflorus, L. (SMALL FLOWERED CROWFOOT.) April and May. Flowers very small.

palmatus, Ell. Rare. April and May.

Aquilegia Canadensis, L. (COLUMBINE.) Mr. Norwood Giles, on the Sound. April and May. Flowers scarlet, yellow within.

MAGNOLIACEÆ. (MAGNOLIA FAMILY.)

Magnolia grandiflora, L. (MAGNOLIA.) Northern limit in Brunswick county. May. Flowers white.

glauca, L. (SWEET BAY.) May—June. Flowers white.

Umbrella, Lam. (UMBRELLA TREE.) May and June. Flowers white.
Liriodendron Tulipifera, L. (TULIP-TREE. POPLAR.)
May and June. Flowers greenish yellow.

ANONACEÆ. (CUSTARD APPLE FAMILY.)

Asimina parviflora, Dunal. (DWARF PAPAW. FETID SHRUB.)
March and April. Flowers greenish purple.

MENISPERMACEÆ. (MOONSEED FAMILY.)

Menispermum Canadense, L. (MOONSEED.) Dr. McRee. Rocky Point:
July. Flowers white.
Cocculus Carolinus, D. C. (REDBERRIED MOONSEED,)
June and August. Flowers white.

BERBERIDACEÆ. (BARBERRY FAMILY.)

Podophyllum peltatum, L. (MAY APPLE.) Not common.
April and May. Flowers greenish, moist shady places.

NELUMBIACEÆ. (NELUMBO FAMILY.)

Nelumbium luteum, Willd. (DUCK ACORN. WATER CHINQUAPIN.)
Is rarely found in Waccamaw Lake, 30 miles from Wilmington.
Found in Neuse river by G. McCarthy, July, 1886.
July. Flowers large yellow.

CABOMBACEÆ. (WATER-SHIELD FAMILY.)

Cabomba Caroliniana, Gray. (*Nectris aquatica Nutt.*)
Ditches in Potter's rice field. June and August. Flowers white.
Brasenia peltata, Pursh. (*Hydropeltis purpurea, Michx.*) (WATER-SHIELD.)
July. Flowers dull purple, under surface of leaves with gelatinous viscid coating.

NYMPHÆACEÆ. (WATER-LILY FAMILY.)

Nymphæa odorata, Ait. (WHITE POND-LILY.) May and June.
Nuphar advena, Ait. (YELLOW WATER-LILY. BONNETS. SPATTER DOCK.)
sagittæfolia, Pursh. (ALLIGATOR BONNETS.)
June—August. Flowers yellow. Found on the margins of the Cape Fear N. E. River and Smith's Creek. Plentiful enough to make their locality a favorite place for fishermen.

SARRACENIACEÆ. (PITCHER-PLANT FAMILY.)

Sarracenia purpurea, L. (PITCHER-PLANT.)
April and May. Flowers purple.
Varieties with erect leaves.

Sarracenia rubra, Walt. (ED-FLOWERED TRUMPET.)
Found in the neighborhood of Rush's. See Map.

flava, L. (BISCUIT. YELLOW TRUMPETS. WATCHES.) March.

variolaris, Michx. (*S. lacunosa of Bartram.*) Spotted.
Trumpet-leaf, 30 miles from Wilmington. Scarce.

PAPAVERACEÆ. (POPPY FAMILY.)

Argemone MEXICANA, **L.** (MEXICAN POPPY.) Introduced.
April and May. Flowers yellow and white. Yellow flowers two or three weeks before white.

var. alba.

Sanguinaria Canadensis, L. (BLOOD-ROOT. PUCCOON-ROOT.)
Not common. March. Flowers white.

Papaver DUBIUM, (*P. rheas*,) Dr. McKee, Rocky Point.
Cultivated fields. Adventive.

FUMARIACEÆ. (FUMITORY FAMILY.)

Corydalis aurea, Willd. March and April. Flowers yellow.

micrantha, Dr. A. Havard. Smithville.

CRUCIFERÆ. (MUSTARD FAMILY.)

Cardamine rhomboidea, D. C. (SPRING CRESS.) Dr. McKee.
Rocky Point. April and May. Flowers white.

hirsuta, L. (BITTER CRESS.)

Cakile maratima, Scop. (SEA KALE.) On the sea beach.
May—August. Flowers pale purple.

Sisymbrium THALIANA, **Gaud.** (MOUSE-EAR CRESS.)
March and April. Flowers White.

canescens, Nutt. (TANSY MUSTARD.)
March and April. Flowers small greenish white.

OFFICINALE, SCOP. (HEDGE MUSTARD.) Introduced.
May and June. Flowers pale yellow.

Draba verna, L. (WHITLOW GRASS.) Flowers small white.

Caroliniana, Walt. February—April. Flowers white.

Senebiera pinnatifida, D. C. (WART CRESS. SWINE CRESS.)
March—May.

Lepidium Virginicum, L. (WILD PEPPER-GRASS.)
March—June. Very common.

Capsella BURSA-PASTORIS, **Mœnch.** (SHEPHERD'S PURSE.) Introduced.
March—June. Flowers white.

CAPPARIDACEÆ. (CAPER FAMILY.)

Gynandropsis pentaphylla, D. C. May—August. Flowers white. (*Cleome pentaphylla, Linn, and Barton, Pursh, Nuttall anp Elliott.*) Waste grounds. Across Wilmington ferry, Cape Fear river. Dr. McKee.

VIOLACEÆ. (VIOLET FAMILY.)

Viola cucullata, Ait. (BLUE VIOLET.) February—May. Flowers blue-white.

palmata, L. (HAND-LEAF VIOLET.) Not common. March—May. Flowers purple or blue.

villosa, Walt. (HAIRY VIOLET.) Flowers pale blue.

lanceolata, L. LANCE-LEAVED VIOLET.) February—May. Floweis white.

pedata, L. (BIRD-FOOT VIOLET.) February—May. Flowers large, deep blue or purple.

primulæfolia, L. (PRIMROSE-LEAVED VIOLET.) Flowers white—small.

blanda, Willd. (SWEET WHITE VIOLET.) April—May. Flowers white.

tricolor, L. Var. arvensis D. C. (WILD PANSY.) Not very common.

CISTACEÆ. (ROCK-ROSE FAMILY.)

Helianthemum Canadense, Michx. (FROST-WEED.) April. [*Cistus Canadensis, Walt.*]

Carolinianum, Michx. (ROCK-ROSE.) March—April. Flowers yellow. [*Cistus Carolinianus, Walt.*]

corymbosum, Michx. April. [*Cistus corymbosus, Pair.*]

Lechea major, Michx. (PIN-WEED.) July—August. Greenish flowers.

minor, Lam. Dry sandy soil. July and August.

DROSERACEÆ. (SUNDEW FAMILY.)

Dionæa muscipula, Ellis. (VENUS FLY-TRAP.)*
June. Flowers white, blacken in drying. Seed drop in July—10th to 20th.
Found abundantly in a radius of a half to three quarters of a mile from 2d toll house and other places. See Map.

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*The original description of the habit of Dionæa, written by Dr. Curtis for his first "Catalogue of Plants Growing Spontaneously Around Wilmington," in 1834, is reproduced, as it stands a most excellent, and perhaps the best sketch yet made.

"DIONÆA MUSCIPULA.—This plant is found as far north as Newbern, N. C., and from the mouth of Cape Fear river nearly to Fayetteville. Elliott says, on the authority of Gen. Pinckney, that it grows along the lower branches of the Santee in South Carolina. Dr. Bachman has received it from Georgetown, *S. C.; and Mr. Audubon informed me, with the plant before us, that he has seen it in Florida of enormous size. I think it not impossible, therefore, that it inhabits the savannahs, more or less abundantly, from the latter place to Newbern.† It is found in great abundance for many miles around Wilmington, in every direction. I venture a short notice of this interesting plant, as I am not aware that any popular description of it has been published in this country.

The leaf, which is the only curious part, springs from the root, spreading upon the ground, or at a little elevation above it. It is composed of a petiole or stem with broad margins, like the leaf of an orange tree, two to four inches long, which at the end suddenly expands into a thick and somewhat rigid leaf, the two sides of which are semi-circular, about two-thirds of an inch across, and fringed around their edges with somewhat rigid ciliæ or long hairs like eye-lashes. It is very aptly compared to two upper eye-lids joined at their bases. Each side of the leaf is a little concave on the inner side, where are placed three delicate, hair-like organs, in such an order that an insect can hardly traverse it without interfering with one of them, when the two sides suddenly collapse and enclose the prey with a force surpassing an insect's efforts to escape. The fringe or hairs of the opposite sides of the leaf interlace, like the fingers of the two hands clasped together. The sensitiveness resides only in these hair-like processes on the inside, as the leaf may be touched or pressed in any other part without sensible effects. The little prisoner is not crushed and suddenly destroyed, as is sometimes supposed, for I have often liberated captive flies and spiders which sped away as fast as fear or joy could hasten them. At other times I have found them enveloped in a fluid of mucilaginous consistence, which seems to act as a solvent, the insects being more or less consumed in it. This circumstance has suggested the possibility of their being made subservient to the nourishment of the plant, through an apparatus of absorbent vessels in the leaves. But as I have not examined sufficiently to pronounce on the universality of this result, it will require further observation and experiment on the spot to ascertain its nature and importance. It is not to be supposed, however, that such a food is necessary to the existence of the plant, but like compost, may increase its growth and vigor. But however obscure and uncertain may be the final purpose of such a singular organization, if it were a problem to construct a plant with reference to entrapping insects, I cannot conceive of a form and organization better adapted to secure that end than are found in the Dionæa Muscipula. I therefore deem it no credulous inference, that its leaves are constructed for that specific object, whether insects subserve to the purpose of nourishment to the plant or not. It is no objection to this view that they are subject to blind accident, and sometimes close upon straws as well as insects. It would be a curious vegetable, indeed, that had a faculty of distinguishing bodies, and recoiled at the touch of one, while it quietly submitted to violence from another. Such capricious sensitiveness is not a property of the vegetable kingdom. The spider's net is spread to ensnare flies, yet it catches whatever falls upon it; and the ant lion is roused from her hiding place by the fall of a pebble; so much are insects also, subject to the blindness of

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*I find upon diligent inquiry that it is not to be found at Georgetown but near Bucksville, S. C., about 70 miles from Wilmington, and is very scarce there. T. F. W.

†The above was written in 1834, but has not since been verified. Dionæa is quite as local as at first found to be, Wilmington being the centre of its most abundant growth.

accident. Therefore the web of the one, and the pitfall of the other are not designed to catch insects ! Nor is it in point to refer to other plants of entirely different structure and habit which sometimes entangle and imprison insects. As well might we reason against a spider's web, because of a fly drowned in a honey pot ; or against a steel trap because some poor animal has lost its life in a cider barrel."

The extent of the distribution of the Dionæa has interested many botanists, and we append some observations on that subject. Although drainage of the savanna land near Wilmington, and frequent accidental fires and fires purposely employed to clear off the savannas to secure grazing for cattle, after the wasteful method handed down by the aborigines, have lessened the numbers of the plant immediately about the town, still some good specimens are occasionally found within the unsettled limits. The distribution of Dionæa is co-extensive with the savanna land, which, it will be safe to say, is as much as one-fifth of the area of this county (New Hanover,) and the adjacent one's of Pender and Brunswick counties. The ravages of fire, and unusual cold seasons and the rapacity of the collectors who supply the trade, have scarcely made perceptible inroads on the plant.

The future of the Dionæa does not incline us to believe that it will be soon exterminated. Land is very abundant, and but few savannas have more than a superficial coating of organic matter overlaying a bed of almost sterile sand, therefore the temptation to cultivate such land will be small, even after the country is thickly settled. It will be a great many years before the population of farmers will become dense enough to regard savanna land as worth much, even for the grazing of stunted cattle, and as the very sensible plan of caring for cattle (and the better breeds are being rapidly introduced) upon the economic basis of good shelter, pure water, and wholesome food becomes an established fact, there will be no temptation to do as wasteful a thing as to burn off a savanna and risk a forest of good trees, to keep a few stunted cattle from starving. The Dionæa is undoubtedly the most remarkable of the very local plants known to botanists, and it will be good news to the friends of science to know its probable future.

Drosera filiformis, Raf. (THREAD-LEAVED SUNDEW.)
April. Flowers bright purple.

longifolia, L. (LONG-LEAVED SUNDEW.)
May and June. Flowers white.

rotundifolia, L. (ROUND-LEAVED SUNDEW.)
May and June. Flowers white.

brevifolia, L. (SHORT-LEAVED SUNDEW.) March. Flowers white:

PARNASSIACEÆ.

Parnassia Caroliniana, Michx. (GRASS of PARNASSUS.)
October and November. Corolla white with impressed greenish veins.

HYPERICACEÆ. (ST. JOHN'S WORT FAMILY.)

Ascyrum Crux-Andreæ, L. (ST. PETER'S WORT.)
June—September. Flowers yellow.

stans, Michx. July—September. Flowers yellow.

***Hypericum angulosum, Michx.** June—August. Flowers almost orange.
corymbosum, Muhl. July. Petals black dotted.
fasciculatum, Lam. June—August. Petals yellow.
nudiflorum, Michx. July—August.
mutilum, L. (*H. parvifolium, Willd. Pursh and Elliott.*) June—August. Flowers minute orange colored.
***rosmarinifolium.** (*H. cistifolium, myrtifolium.*)
***simplex.** (*H. setosum.*)
†**Virginicum.** (*H. corymbosum.*)
Canadense, L. June—October. Flowers copper yellow.
Sarothra, Michx. (GROUND PINE.) [*Sarothra gentianoides, L.*] June—August. Flowers small yellow.

PORTULACACEÆ. (PURSLANE FAMILY.)

Claytonia Virginica, L. (SPRING BEAUTY.) April—May. Flowers rose colored, veiny; not common.
Portulaca OLERACEA, L. (PURSLANE.) Common in streets and cultivated fields. Introduced. May—July. Flowers yellow.
Sesuvium pentandrum, Ell. (SEA PURSLANE.) Saline marshes. May—November.
portulacastrum, L. May—November.

CARYOPHYLLACEÆ. (PINK FAMILY.)

Arenaria Canadensis* (*diffusa ?*) (*A. rubra*, found near Sound. Dr. McRee.)
diffusa, Ell. April—June. Flowers white.
SERPYLLIFOLIA, L. (THYME-LEAVED SANDWORT.) Introduced. June. Petals white.
Cerastium VISCOSUM, L. (*C. hirsutum, Muhl., Ell., &c.*) Introduced. February—May. Flowers white.
VULGATUM, L. (MOUSE-EAR CHICKWEED.) Introduced. February—May. Flowers white.
Mollugo verticillata, L. (INDIAN CHICKWEED.) May—August. Flowers small white.
Alsine squarrosa, Fenzl. (BARRENS SANDWORT.) Dry sand hills. April—May. Flowers white.
Saponaria OFFICINALIS, L. (SOAPWORT. BOUNCING BET.) Introduced. Waste grounds. July—August. Flowers white or rose-color.
Silene Antirrhina, L. (CATCHFLY.) July. Flowers small red.
Virginica, L. (INDIAN PINK.) June. Flowers large red.
Pennsylvanica, Michx. Lilliput on Cape Fear River. (Dr. McRee.) April. Petals white or rose-color.

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*Not given in Curtis' Catalogue of Indigenous Plants. See page 12.

†Synonym for *corymbosum* given above.

Spergula ARVENSIS, L. (PINE CHEAT. CORN SPURREY.)
May—August. Flowers white.

Spergularia rubra, Pers. (SAND SPURREY.) Sea-coast.
May—October. Flowers red or rose.

Stellaria MEDIA, **Smith.** (CHICKWEED.) Introduced.
December—April. Flowers white.

uniflora, Walt.

Paronychia herniarioides, Nutt. July—October. Flowers minute.

Anychia dichotma, Michx. July—August. Flowers greenish.

Stipulicida setacea, Michx. White sand hills. Common.
April—June. Flowers white.

Sagina Elliottii, Fenzl. (BARRENS SANDWORT.) April—June.

MALVACEÆ. (MALLOW FAMILY.)

Hibiscus Moscheutos, L. (SWAMP MALLOW.)
July. Flowers white or pale rose, crimson centre.

Hibiscus aculeatus, Walt. (*H. Scaber, Michx.*)
July. Flowers white with purple centres.

militaris, Cav. (*H. Virginicus, Walt.*) (ROSE-MALLOW.)
Causeway and Little Bridge. July—August. Flowers rose.

Malva ROTUNDIFOLIA, L. (MALLOW.) Introduced. Common in waste grounds.
May—August. Petals pale pink.

Sida SPINOSA, L. Common about settlements. Introduced. See Abutilon.
July—August. Petals yellow.

[*S. Abutilon, Avicennæ, Gærtn.*]

Elliottii, T. and G. July—October. Flowers orange yellow.

Abutilon AVICENNÆ, **Gaert.** (VELVET LEAF AMERICAN HEMP.) Introduced.
June—July. Flowers yellow.

Kosteletzkya Virginica, Presl.

TILIACEÆ. (LINDEN FAMILY.)

Tilia pubescens, Ait. (LINN OR LIME TREE.) June. Flowers cream color.

heterophylla, Vent. (White Linn.)

Americana, L. Dr. McRee. Rocky run.
[*Tilia glabra, Vent*]

CAMELLIACEÆ. (CAMELLIA FAMILY.)

Gordonia Lasianthus, L. (LOBLOLLY BAY. BLACK LAUREL.)
July—August. Flowers white.

Stuartia Virginica, Cav. Scarce.
April—May. Flowers white, stamens purple.
Found eight miles W. from Wilmington by Mr. Wm. Watters.

MELIACEÆ.

Melia AZEDARACH, L. (CHINA TREE. PRIDE OF INDIA.)
May—June. Flowers lilac.

LINACEÆ. (FLAX FAMILY.)

Linum Virginianum, L. (WILD FLAX.) July. Flowers yellow.
Bootii, Planch. Dry pine woods. July. Flowers sulphur yellow.

OXALIDACEÆ. (WOOD-SORREL FAMILY.)

Oxalis stricta, L. (YELLOW WOOD SORRELL.) April. Flowers yellow.
violacea, L. (PURPLE WOOD SORRELL.) Dr. McRee, Rocky Point.
May—June. Flowers nodding, purple.

ZYGOPHYLLACEÆ. (BEAN CAPER FAMILY.)

Tribulus CISTOIDES, L. Waste grounds. Dr. McRee. Flowers large yellow.
TERRESTRIS, L. Ballast. Introduced from South Russia.

GERANIACEÆ. (GERANIUM FAMILY.)

Geranium Carolinianum, L. March—April. Flowers pale purple.
maculatum, L. (CRANE'S BILL.) Dr. McRee.
April—May. Flowers purple.

BALSAMINACEÆ. (BALSAM FAMILY.)

Impatiens fulva, Nutt. (JEWELL WEED.) Causeway, rice fields, Little Bridge. July—September. Flowers deep orange.
pallida, Nutt. (TOUCH-ME-NOT.) Gerald McCarthy.

RUTACEÆ. (RUE FAMILY.)

Zanthoxylum, Carolinianum, Lam. (PRICKLY ASH. TOOTHACHE TREE.)
[*Z. clava-Herculis*, *Linn.*] June. Flowers small greenish.
Ptelea trifoliata, L. (HOP-TREE. WAFER-ASH.) Wrightsville Sound.
May—June. Flowers greenish.
mollis, M. A. C. May—June. Flowers greenish.

ANACARDIACEÆ. (CASHEW FAMILY.)

Rhus copallina, L. (Common Sumack.) July. Flowers greenish.
Toxicodendron, L. (Poison Oak.) July. Flowers small.
radicans, L. (Poison Vine.) July. Flowers greenish.
Rhus venenata, D. C. (Poison Sumach.) July. Flowers very small—green.
pumila, Michx. (Dwarf Sumach.) Pine woods.

VITACEÆ. (VINE FAMILY.)

Vitis æstivalis, Michx. (Summer Grape.) June. Grape deep blue, very austere.
Labrusca, L. (Fox Grape.) May—June. Grape purple or whitish, pleasant.
vulpina, L. (Muscadine. Bullace.) June. Grape purple, pleasant.
cordifolia, Michx. (Frost Grape.) May—June. Grape black, acid.
bipinnata, Torrey & Gray. June—July. Grape small, black.
Ampelopsis quinquefolia, Michx. (Virginia Creeper.) June. Flowers inconspicuous, greenish.

RHAMNACEÆ. (BUCKTHORN FAMILY.)

Ceanothus Americanus, L. (Red-root. Jersey Tea.) July. Flowers white.
Berchemia volubilis, D. C. (Rattan. Supple Jack.) June. Flowers small, greenish.
Sageretia Michauxii, Brongn. Sea coast. September. Flowers white.
Frangula Caroliniana, Gray. June.

CELASTRACEÆ. (STAFF-TREE FAMILY.)

Euonymus Americanus, L. (Strawberry Bush. Bursting Heart. Fish-wood.) May—June. Flowers greenish.

STAPHYLLACEÆ. (BLADDER-NUT FAMILY.)

Staphylea trifolia, L. (Bladder Nut.) Introduced. May. Flowers white.

SAPINDACEÆ. (SOAP-BERRY FAMILY.)

Æsculus Pavia, T. (Red Buckeye. Horse-chestnut.) March—May. Flowers red.

ACERACEÆ. (MAPLE FAMILY.)

Acer rubrum, L. (Red Maple.) February—March. Flowers and fruit red.
saccharinum, Wang. (Sugar Maple.) Rock spring. Rocky Point. April and May.
Negundo aceroides, Mœnch. (Ash-leaved Maple.) Rocky Point and in Wilmington. March and April.

POLYGALACEÆ. (MILKWORT FAMILY.)

Polygala cymosa, Walt. Moist savannahs. Common. July. Flowers yellow, turning dark green in drying.
cruciata, L. July—October. Flowers pale rose color.
incarnata, L. Moist savannahs. Common. June—August. Flowers purple.
lutea, L. (Batchelor's Button.) Savannahs. Abundantly common. June—August. Flowers orange yellow.
ramosa, Ell. July—September. Flowers yellow.
fastigiata, Nutt. Not as common as others. July—October. Flowers small, bright rose color.
setacea, Michx. March—July. Flowers pale rose color or whitish.
brevifolia, Nutt. July—October. Flowers reddish purple.
grandiflora, Walt. July—September. Flowers bright purple.
Verticillata, L. June—August. Flowers greenish white.

LEGUMINOSÆ. (PULSE FAMILY.)

Amorpha fruticosa, L. (Indigo Bush.) May—June. Flowers blue.
herbacea, Walt. (A. Pubescens Willd.) June—July. Flowers blue or white.
Amphicarpæa monoica, Nutt. (Pea-vine.) August—Septempter, Flowers white or purplish.
Apios tuberosa, Mœnch. (Ground nut.) This common name must not be confounded with "ground nut," the local name for Arachis hypogeæ, the introduced African "pea-nut" of commerce. July—August. Seeds black. Flowers brownish purple.
Astragalus glaber, Michx. April. Flowers white.
Baptisia lanceolata, Ell. April—May. Flowers yellow.
villosa, Ell. May. Plants turns black in drying.
alba, R. Br. April. Flowers white.
tinctoria, R. Br. (Wild Indigo.) May—June. Flowers yellow.
Cassia Chamæcrista, L. July—August. Flowers yellow, petals often purple at the base.
Marylandica, L. (Wild Senna.) August. Flowers yellow.
occidentalis, L. July. Flowers large, yellow.
obtusifolia, L. (*C. Tora Linn.*) July—October. Flowers yellow.
nictitans, L. (Wild Sensitive Plant.) July. Flowers pale yellow.

Cercis Canadensis, L. (RED-BUD.) March. Flowers rose colored.
Crotalaria sagittalis, L. (RATTLE-BOX. June—July. Flowers yellow.
ovalis, Pursh. April—June. Flowers showy, yellow.
Purshii, D. C. May—July. Flowers yellow.
Lupinus diffusus, Nutt. April—May. Flowers blue.
perennis, L. (LUPINE.)
April—May. Flowers purplish or purplish blue.
villosus, Willd. April—June. Flowers violet and roseate above.
Trifolium ARVENSE **L.** (RABBIT-FOOT CLOVER.)
July—August. Flowers pale red.
Carolinianum, Michx. (CAROLINA CLOVER.) Dr. McRee, Rocky Point. Introduced. March—May. Flowers white or purplish.
pratense, L. (RED CLOVER.) Introduced. All summer.
hybridum, L.* Gerald McCarthy.
repens, L. (WHITE CLOVER.) May—September.
reflexum, L. (BUFFALO CLOVER.) April—June. Flowers rose red.
PROCUMBENS, **L.** (YELLOW CLOVER.) Introduced. June—July.
Medicago LUPULINA, **L.** (HOP. MEDICK.) Common in grass plats. Introduced.
May—October. Flowers small, yellow.
denticulata.* G. McCarthy.
Psoralea melilotoides, Michx. May—July. Flowers violet.
canescens, Michx. (BUCK ROOT.) May—July. Flowers blue.
lupinellus, Michx. May—June. Flowers.
Robinia PSEUD-ACACIA, **L.** (WHITE LOCUST.)
Introduced as shade trees from the mountains. March—April.
hispida, L. (ROSE LOCUST.) April—May. Flowers rose.
var. nana, Ell. PINE WOODS.
Wistaria frutescens, D. C. (VIRGIN'S BOWER.)
(*Thyrsanthus frutescens*, Ell.) April—May. Flowers lilac.
†Tephrosia Virginiana, Pers. (RABBIT PEA.)
July. Banner white, heel rose colored, wings red.
hispidula, Pursh. May—August. Flowers reddish purple.
ambigua, M. A. C. June—July. Flowers white and purple.
spicata, T. & G. June—July. Flowers large, white and purple.
Indigofera Caroliniana, Walt. (CAROLINA INDIGO.)
July—September. Flowers reddish brown.
Lathyrus paluster, Linn. June—July. Flowers blue and purple.
‡var. myrtifolium, Gray.
Æschynomene hispida, Willd. (*Hedysarum* —— ?)
August. Flowers small, yellow.
Zornia tetraphylla, Michx. June—August. Flowers deep yellow.

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*Not given in Curtis Catalogue.

†Tephrosia is substituted as the name of this genus, following Curtis' Catalogue of Indigenous Plants, p. 17.

‡Watson's Index, p. 230.

Styloshanthes elatior, Swartz. (PENCIL FLOWER.)
July—August. Flowers yellow.

Lespedeza capitata, Michx. (BUSH CLOVER.) August—September.
repens, T. & G. Common. August—September.
procumbens.* G. McCarthy.
violacea, Persoon. July—August. Flowers.
" **var. sessiliflora, Persoon.** July—August.
hirta, Ell. August—September. Flowers reddish white.
stuvei, Nutt.

†**Desmodium nudiflorum, DeCandolle.** (*Hedysarum nudifolium*, Linn.)
August. Flowers small, purple.
cuspidatum, T. & G. August. Flowers large, purple.
viridiflorum, Beck. (*H. viridifolium, Elliott.*)
August. Flowers yellow, green when dry.
rotundifolium, DeCan. (*H. rotundifolium, Michx*)
August. Flowers purple.
ochroleucum, M. A. C. August. Flowers yellow.
Dillenii, Darlington. (*Hedysarum Marilandicum, Willd.*)
July. Flowers purple.
glabellum, DeCan. August—September.
paniculatum, DeCan. July—August. Flowers purple.
strictum, DeCan. August. Flowers small, purple.
Marilandicum, Boott. August. Flowers violet purple.
rigidum, DeCan. August. Flowers violet purple.
lineatum, DeCan. Flowers and legume small.

Rhynchosia tomentosa, T. & G. (*Glycine tomentosa, Linn.*)
Flowers yellow.
" **var. monophylla, T. & G.**
" **var. volubilis, T. & G.**
" **var. erecta, T. & G.**

Gleditschia triacanthos, L. (HONEY LOCUST.)
June. Flowers small, green.

Clitoria Mariana, Linn. (*Vexillaria Mariana Eaton.*)
July—August. Flowers pale purple.

Phaseolus perennis, Walt. (WILD BEAN.)
July—August. Flowers purple and violet.
diversifolius, Pers. August—October. Flowers purplish.
helvolus, L. August—September. Flowers purplish.

Erythrina herbacea, L. April—June. Flowers deep scarlet.

Galactia pilosa, Nuttall. June—September. Flowers roseate.
var. Macraei,* M. A. C. (Watson's Index, 221)
glabella, Michx.

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*Not given in Curtis' Catalogue.

†Generic name Desmodium substituted for Hedysarum. See Cat. Indig. Plants, p. 19.

Schrankia augustata, T. & G. (SENSITIVE PLANT.)
May—July. Flowers purplish.

Arachis HYPOGÆA, **Willd.** (PEA-NUT. GROUND-NUT.)
Introduced and cultivated as a crop plant.
May—August. Flowers yellow.

Vicia SATIVA, **L.** (VETCH. TARE.) Introduced—cultivated grounds.
April—May. Flowers pale purple.

HIRSUTA, **Koch.** Introduced. April—May. Flowers blueish white.

TETRASPERMA, **Loisel.**

Melilotus OFFICINALIS, **Willd.** (YELLOW MELILOT.)
Naturalized about old clearings.

ALBA, **Lam.** (WHITE MELILOT.) Naturalized about old clearings.

Petalastemon corymbosum, Michx.
September—October. Flowers white.

Centrosema Virginiana, Benth. Dry soil. June—September.

ROSACEÆ. (ROSE FAMILY.)

Agrimonia Eupatoria, L. (FEVERFEW.) July. Flowers yellow.

parviflora, Ait. August. Flowers (petals) yellow.

Fragaria Virginiana, Ehrhenberg. (STRAWBERRY.).
January—May. Flowers white.

INDICA, **Ait.** (INDIAN STRAWBERRY.) April—May. Flowers white.

Geum album, Gmelin. (AVENS.) July. Flowers small, white.

Potentilla NORVEGICA, **L.** Rare. Introduced.
July—September. Flowers pale yellow.

Canadensis, L. (FIVE-FINGER.) Very common.
April—August. Flowers yellow.

Rosa Carolina, L. (SWAMP ROSE.) Common, most in wet grounds.
May—June.

lucida, Ehrh. (WILD OR DWARF ROSE.) Common in dry woods.
May—July.

RUBIGINOSA, **L.** (SWEET-BRIER.) Near settlements. Introduced.
May. Flowers orange-red.

LÆVIGATA, **Michx.** (CHEROKEE ROSE.) Meares' Bluff.
April. Flowers white.

Rubus villosus, Ait. (HIGH BLACKBERRY.)
February—April. Flowers white.

cuneifolius, Pursh. (LOW BLACKBERRY.)
Common on old fields and roadsides.
February—March. Flowers white.

trivialis, Michx. (DEWBERRY.) February—April. Flowers white.

Prunus Americana, Marsh. (RED PLUM.) March—April. Flowers white.

Chicasa, Michx. (CHICASAW PLUM.) April. Flowers white.

Prunus Caroliniana, Ait. (MOCK ORANGE.) Dr. McRee.
Seacoast of Brunswick county. Introduced as an ornamental shade tree. Fruit very poisonous.

Spiræa tomentosa, L. (HARDHACK.)
June—July. Flowers small, stamens purple.

opulifolia, L. (HARDHACK.) Ger. McCarthy.

Cratægus spathulata, Michx. (NARROW-LEAVED THORN.)
April—May. Flowers small, white.

glandulosa, Michx. (HAIRY THORN.)

flava, Ait. (SUMMER HAW.) April—May. Flowers white.

parvifolia, Ait. (DWARF THORN.)

apiifolia, Michx. (PARSLEY-LEAVED HAW.)
March—April. Flowers large, white or roseate.

crus-galli, L. (COCK'S-SPUR THORN.)

Pyrus angustifolia, Ait. (NARROW-LEAVED CRAB.)
March. Flowers rose purple.

arbutifolia, L. (CHOKEBERRY.) March—May. Flowers white.

Amelanchier Canadensis, L. (SERVICE TREE.)
March—May. Flowers white.

CALYCANTHACEÆ. (CAROLINA ALL-SPICE FAMILY.)

Calycanthus FLORIDUS, **L.** (SWEET SHRUB.) Introduced.
April and May. Flowers brown.

MELASTOMACEÆ. (MELASTOMA FAMILY.)

Rhexia Mariana, L. June—September. Flowers purple.

var. lanceolata. (*R. angustifolia, Nutt.*)
June—August. Flowers white or pale purple.

***Virginica, L.** (MEADOW BEAUTY.)
July and August. Flowers bright purple.

glabella, Michx. (DEER-GRASS.)
June—August. Flowers pale purple.

lutea, Walt. June—August. Flowers yellow.

ciliosa, Michx. June—August. Flowers purple.

LYTHRACEÆ. (LOOSESTRIFE FAMILY.)

Lythrum alatum, Pursh. (LOOSESTRIFE.) June—July. Flowers purple.

liniare, L. June. Flowers nearly white.

Nesæa verticillata, H. B. & K. (SWAMP LOOSESTRIFE.)
July—August. Flowers purple.

Ammannia humilis, Michx. (**var. ramosior, Michx.**) Petals purplish.

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*Curtis does not corroborate this in Cat. Indig. Plants.

ONAGRACEÆ. (EVENING-PRIMROSE FAMILY.)

Gaura angustifolia, Michx. Dry old fields and sandy places. Flowers white.

Œnothera biennis, L. (EVENING PRIMROSE.) Green's (Kidder's) lower rice field. Common mostly in plantations. Flowers yellow.

fruticosa, L. (SUNDROPS.) River banks. June. Flowers yellow.

sinuata, L. Drift sand, near coast. May—September. Flowers small, axillary.

var. humifusa. Sea beach.

riparia, Nutt. Swamps and river banks. June—July.

Jussiæa decurrens, D. C. (*Ludwigia decurrens.*) Sides of ditches. July.

Ludwigia alternifolia, L. (SEED-BOX.) (*L. macrocarpa Michx.*) August. Flowers yellow.

capitata, Michx. July—August. Flowers yellow.

linearis, Walter. July—September. Flowers yellow.

pilosa, Walter. (*L. Moltis Michx.*) July—September. Flowers yellow.

virgata, Michx. July—August. Flowers yellow.

hirtella, Rob. Pine woods. August.

palustris, Elliott. (WATER PURSLANE.) June—September.

linifolia, Poir. Ditches and swamps. July—September.

natans, Elliott. July—September.

arcuata, Walter. Ditches and margin of ponds. July.

sphærocarpa, Elliott. Rare. July—September.

Proserpinaca palustris, L. (MERMAID WEED.) June—August. Flowers greenish.

pectinacea, Lam. July—August.

Myriophyllum verticillatum, L. (WATER MILFOIL.) July. Flowers small, green axilla.

heterophyllum, Michx. July

CACTACEÆ. (CACTUS FAMILY.)

Opuntia vulgaris, Mill. (PRICKLY PEAR.) (*Cactus opuntia.*) May—June. Flowers yellow.

PASSIFLORACEÆ. (PASSION FLOWER FAMILY.)

Passiflora incarnata, L. (MAY-POP. PASSION FLOWER.) June—July. Flowers purple and white.

lutea, L. June—July. Flowers small, greenish yellow.

CUCURBITACEÆ. (GOURD FAMILY.)

Lagenaria VULGARIS, **Sering.** (GOURD.) About settlements. May—June. Flowers yellow.
Sicyos angulatus, L. (ONE-SEEDED CUCUMBER.) G. McCarthy.
Melothria pendula, L. In rice fields and elsewhere. May—August. Flowers small, yellow.

CRASSULACEÆ. (ORPINE FAMILY.)

Penthorum sedoides, L. Ditch stone crop. July—September.

SAXIFRAGACEÆ. (SAXIFRAGE FAMILY.)

Saxifraga Virginiensis, Pursh. (EARLY SAXIFRAGE.) April—May. Flowers white.
Heuchera Americana, L. (ALUM-ROOT.) April—May. Flowers white.
Itea Virginica, L. May—June. Flowers white.
Decumaria barbara, L. (*D. sarmentoso, Ell.*) May—June. Flowers odorous, white.

HAMAMELACEÆ. (WITCH-HAZEL FAMILY.)

Hamamelis Virginica, L. (WITCH-HAZEL.) Winter. Flowers yellow.
Fothergilla alnifolia, L. (DWARF ALDER.) March—April. Flowers white.
Liquidambar Styraciflua, L. (SWEET-GUM.) May.

UMBELLIFERÆ. (PARSLEY FAMILY.)

Hydrocotyle repanda, Pers. June—August.
umbellata, L. (WATER GRASS.) May—July.
ranunculoides, L. July—August.
interrupta, Muhl. June.
Cicuta maculata, L. (WATER HEMLOCK. WILD PARSNIP.) July. Flowers white.
Daucus pusillus, Michx. (DWARF CARROT.) Smithville. June. Flowers white or yellowish.
Eryngium yuccæfolium, Michx. (BUTTON SNAKEROOT.) (*E. aquaticum, Linn.*) June. Flowers blue.
Virginianum, Lam. July. Flowers blue.
virgatum, Lam. August. Flowers blue.
præaltum, Gray. (*E. Virginianum, Ell.*) August. Flowers white.
Archemora rigida, D. C. (COWBANE. PIG POTATOE.) (*Sium denticulatum.*) August—September. Flowers white.
ternata, Nutt. November. Flowers white.

Sanicula Canadensis, L. (Sanicle.) May.

Marylandica, L. May.

Discopleura capillacea, D. C. (Bishop Weed.) (*Sison capillacens.*) June—July. Flowers white.

costata.* Gerald McCarthy.

Tiedemannia teretifolia, D. C. (Water Drop-Wort.) (*Oenanthe filiformis, Walt.*) August. Flowers white.

Crantzia lineata, Nutt. Muddy banks of rivers. July. Flowers small whitish.

Pastinaca sativa, **L.** (Parsnip.) About settlements.

Leptocaulis divaricatus, D. C. Dry sandy soil. April. Flowers white.

Thaspium barbinode, Nutt. River banks. May—June. Flowers pale yellow.

aureum, Nutt. (Meadow Parsnip.) Rocky Point—rich soil. May. Flowers yellow.

ARALIACEÆ. (GINSENG FAMILY.)

Aralia spinosa. (Prickly Ash. Hercules Club) July—August. Flowers whitish.

CORNACEÆ. (DOGWOOD FAMILY.)

Cornus florida, L. (Dogwood.) May. Involucre white.

stricta, Lam. April. Involucre white.

Nyssa multiflora, Wang. (Sour Gum. Tupelo.) May. Flowers greenish.

aquatica, L. (Black Gum.) April—May. Flowers minute.

uniflora, Walt. (Cotton Gum.) Deep swamps. Point Peter near R. R. bridge. April. Flowers small, greenish.

CAPRIFOLIACEÆ. (HONEYSUCKLE FAMILY.)

Lonicera sempervirens, Ait. (Woodbine.) April—September. Flowers red.

Sambucus Canadensis, L. (Elder.) June—July. Flowers white.

Viburnum prunifolium, L (Black Haw.) April—May. Flowers small, white.

nudum, L. (Possum Haw. Shawnee Haw.) April—May.

dentatum, L. (Arrowwood.) March—May.

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*Not given in Curtis' Catalogue.

RUBIACEÆ. (MADDER FAMILY.)

Galium pilosum, Ait. June—September. Flowers purple.
hispidulum, Michx. May—September. Flowers greenish-white.
trifidum, L. (SMALL BEDSTRAW.) June—July. Flowers white.
circæzans, Michx. (WILD LICORICE.) July. Flowers purple.
Diodia Virginiana, L. (BUTTON WEED.) (*D. tetragona.*) June—September. Flowers white or purplish.
teres, Walter. June—September. Flowers purplish.
Cephalanthus occidentalis, L. (BUTTON-BUSH. BOX.) June. Flowers white.
Mitchella repens, L. (WILD RUNNING BOX.) March—April. Flowers white.
Oldenlandia cœrulea, Gray. (BLUETS.) February—March. Flowers pale blue.
purpurea, Gray. June—July. Flowers purple or nearly white.
var. longifolia, Gray.
glomerata, Michx. July. Flowers greenish white.
Gelsemium sempervirens, Ait. (YELLOW JESSAMINE.) March—April. Flowers yellow.
Spigelia Marilandica, L. (PINK ROOT.) Rare. July. Flowers red.
Mitreola petiolata, T. & G. (MITREWORT.) Muddy banks. June—September. Flowers small, white.
sessilifolia, T. & G. Grassy swamps. July—September.
Polypremum procumbens, L. June—September. Flowers small, white.

COMPOSITÆ. (COMPOSITE FAMILY.)

Achillea millefolium, L. (MILFOIL. YARROW.) June—September. Flowers white or rose.
Ambrosia artemisiæfolia, L. (RAGWEED. STICK-WEED. CARROT-WEED.) August—September. Flowers unsightly.
Maruta COTULA, **D. C.** (*Anthemis cotula.*) (MAY WEED. FALSE CHAMOMILE.) Dr. McRee at F. Waddell's. Streets and roadsides. June—September. Rays white.
Aster concolor, L. August—September. Rays purple, pappus rust colored.
undulatus, L. August—September. Flowers pale blue.
dumosus, L. September. Rays purplish white.
flexuosus, Nutt. Salt marshes. August—October. Flowers purple.
paludosus, Ait. August—October. Rays violet blue.
linifolius, L. Salt marshes. October.
Elliottii, T. & G.
spectabilis, Ait.
squarrosus, Walter. September—November. Rays blue.
patens, Ait.

simplex, Willd. September. Rays pale blue.
miser, L.
Novi-Belgii, L. Rays pale blue or purplish.
carneus, Nees.
Novæ Angliæ, L. Rays violet purple.
longifolius, Lam.

Baccharis halimifolia, L. (GROUNDSEL.) September—October. Flowers white.
glomeruliflora, Pers. (*B. Sessiliflora, Michx.*) November. Flowers white.

Baldwinia uniflora, Nutt. Brunswick county. Disk flowers, dark purple.

Bidens bipinnata, L. (SPANISH NEEDLES. BEGGAR-LICE.) August—September. Rays yellow.
chrysanthemoides, Michx. (BUR-MARIGOLD.) September—October.
frondosa, L. July—September.

Boltonia glastifolia, L'Her. July—September. Rays white.

Pyrrhopappus Carolinianus, D. C. (*Barkhausia Caroliniana, Ell.*) (FALSE DANDELION.) April—July. Flowers yellow.

Borrichia frutescens, D. C. (SEA OX-EYE.) (*Buphthalmum frutescens, L.*) Salt marshes. June—October. Flowers yellow.

Chaptalia tomentosa, Vent. February—April. Flowers white or purplish.

Leucanthemum VULGARE, **Lam.** (WHITE DAISY. WHITE WEED.) (*Chrysanthemum leucanthemum, L.*) Introduced. Found in meadows. Common in vacant lots. May—July. Flowers white.

Bigelovia nudata, D. C. (*Chrysocoma nudata, Michx.*) August—September, Flowers yellow.

Chrysogonum Virginianum, L. February—March. Flowers yellow.

Chrysopsis graminifolia, Nutt. (SILVER GRASS. SCURVY GRASS.) August—September. Flowers yellow.
Mariana, Nutt. September.
gossypina, Nutt. September. Flowers yellow.
var. dentata, Ell. Leaves larger than the above; lowest leaves semi-ate toothed.
trichophylla, Nutt.

***Cirsium altissimum, Spreng.** August—September. Flowers purple.
horridulum, Michx. (YELLOW THISTLE.) Causeway between the ferries. April—May. Flowers often purple.
repandum, Michx. Sand barrens. June—July. Flowers purple.
†Virginianum, Michx. August—September. Flowers purple.

Coreopsis lanceolata, L. May—June. Rays yellow.
integrifolia, Poir. September. Rays yellow.

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*The generic name Cirsium is substituted for Cnicus, following Dr. Curtis' Catalogue of Indig. Plants, p. 33, and Chapman's Botany, p. 247.

†Conyza Marilandica and C. bifrons, given in Plants around Wilmington, are omitted from Curtis' Catalogue of Indig. Plants.

aurea, Ait. (*C. mitis, Michx.*)
August—October. Rays yellow, showy.

trichosperma, Michx. (TICK-SEED. SUNFLOWER.) September.

verticillata, L. (*C. tenuifolia. Ell.*) August. Disk yellow.

auriculata, L. June—September. Rays yellow, showy.

discoidea, T. & G. July—September.

angustifolia, Ait. September—October. Rays yellow.

***Eclipta erecta, L.** September—October. Flowers white.

Elephantopus Carolinianus, Willd. (ELEPHANT'S FOOT.)
July—August. Flowers purple.

tomentosus, L. (*E. nudicaulis, Ell.*)
June.—August. Flowers pale purple.

Erigeron bellidifolium, Muhl. (ROBIN'S PLANTAIN.)
March—April. Rays blueish yellow.

Canadensis, L. (HORSE-WEED. HOG-WEED.)
May—September. Rays white.

Philadelphicum. L. (FLEABANE.) May. Rays purplish

vernum, T. & G. (*E. nudicaule, Michx.*) April. Rays white.

strigosum. Muhl. (DAISY FLEABANE.) June. Rays white or rose.

Eupatorium album, L. September.

aromaticum, L. (WILD HOREHOUND.) September. Flowers white.

coronopifolium, Willd. (DOG FENNEL.)
September—October. Flowers white.

fœniculaceum, Willd. (DOG FENNEL.)
September—October. Flowers white.

incarnatum, Walt. Dr. McRee. Rocky Point.
September. Flowers pale purple.

hyssopifolium, L. (*E. linearifolium, Walt.*) September.

perfoliatum, L. (WILD SAGE. BONESET. THOROUGHWORT.)
September. Flowers white.

serotinum, Michx. September.

rotundifolium, L. August.

teucrifolium, Willd. (*E. verbenæfolium, Michx.*)
September. Flowers white.

Gnaphalium polycephalum, Michx. (EVERLASTING.)
September—October. Flowers yellow.

purpureum, L. (CUDWEED.)
April—June. Purplish scales; corolla yellow.

Helenium autumnale, L. (SNEEZE-WEED.)
August—September. Flowers yellow.

quadridentatum, Labill. June—August. Rays yellow.

†tenuifolium, Nutt. G. McCarthy.

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*The specific name procumbens is given by Dr. Curtis in his "Plants around Wilmington." The only two species described by Chapman (p. 224.) The plants are erect.

†Not given in Curtis' Catalogue.

Helianthus angustifolius, L. (SUNFLOWER.) October. Flowers yellow.
atrorubens, L. (*H. sparsifolius, Ell.*) September—October. Flowers yellow.
heterophyllus, Nutt.
giganteus, L. September. Rays yellow.
annuus, L.* G. McCarthy.
Hieracium Gronovii, L. September—October. Flowers yellow.
paniculatum, L. August—September. Flowers yellow.
Iva frutescens, L. (MARSH ELDER.) August—September. Flowers whitish.
imbricata, Walt. Sea coast. August—September. Flowers whitish.
Krigia Virginica, Willd. March—May. Flowers yellow.
Caroliniana, Nutt. February—March. Flowers yellow.
Kuhnia Eupatorioides, L. (*K. critonia, Ell.*) September. Flowers yellowish white.
Lactuca elongata, Muhl. (WILD LETTUCE.) July—September. Flowers white, purple, blue or yellow.
var. graminifolia, M. A. C.
†**Taraxacum Dens-Leonis, Desf.** (DANDELION.) (*Leontodon Taraxacum*) May—August. Flowers yellow.
Leptopoda puberula, Macbride. April—May. Disk yellow.
‡**fimbriatum, Gray.** April—May. Disk yellow.
§**Trilisa odoratissima, Cass.** (VANILLA-PLANT. DOG-TONGUE.) July—August. Flowers purple.
paniculata, Willd. September. Flowers pale purple or white.
spicata, Willd. (BUTTON SNAKEROOT.) August. Flowers bright purple.
Cichorium INTYBUS, **L.** (CHICCORY.) Adventive—found in ballast. July. Flowers yellow.
Liatris squarrosa, Willd. (BLAZING STAR.) July—August. Flowers purple.
tenuifolia, Nutt. September. Flowers purple.
pauciflora, Pursh. September. Flowers purple.
elegans, Willd.* G. McCarthy. August. Flowers purple.
graminifolia, Pursh. September. Flowers purple.
Marshallia angustifolia, Pursh. July—August. Flowers purplish with blue anthers.
lanceolata, Pursh April—June. Flowers purplish.
Mikania scandens, Willd. (CLIMBING HEMP-WEED.) (*M. pubescens, Muhl.*) August—September. Flowers whitish.

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*Not given in Curtis' Catalogue.

†In "Plants around Wilmington," 1834, this plant is marked "rare." It is now very common in the steets and elsewhere, (1880.)

‡This is omitted in "Curtis' Catalogue of Indig. Plants."

§Formerly Liatris.

Polymnia Uvedalia, L. (BEAR'S-FOOT.)
July—August. Rays bright yellow.
Prenanthes alba, L. (*Nabalus albus, Hook.*) September. Flowers white.
virgata, Mich. (*Nabulus virgatus, D. C.*)
September. Flowers purplish.
altissima, L. (*Nabulus altissimus, Hook.*)
September. Flowers yellowish or greenish white.
Pterocaulon pycnostachyum, Ell. (BLACK-ROOT.)
June—July. Flowers white.
Melanthera hastata, Michx. August—September.
Rudbeckia hirta, L. (CONE FLOWER.) July—August. Rays yellow.
Senecio lobatus, Pers. March—April. Flowers yellow.
tomentosus, Michx. April—May. Flowers yellow.
Erechthites hieracifolia, Rafinesque. (FIREWEED.)
(*Senecio hieracifolius, L.*) July—September. Flowers greenish.
Silphium compositum, Michx. (ROSIN-WEED.)
See note in Gray's "Flora of North America."
July—September. Flowers yellow.
Solidago cæsia, L. September. Flowers yellow.
odora, Ait. (ANISE-SCENTED GOLDEN-ROD.)
October. Flowers yellow.
verna, M. A. C. Found on Duplin Road 3 to 5 miles from Wilmington, near Prigge's. See Map. May—June. Flowers yellow.
sempervirens, L. (*S. limonifolia, Pers.*)
September—October. Flowers yellow.
bicolor, L. September. Rays whitish.
tenuifolia, Pursh. October. Flowers yellow.
arguta, Ait. September. Flowers yellow.
var. juncea. September. Flowers yellow.
tortifolia, Ell. September. Flowers yellow.
***altissima, L.** (*S. rugosa, Ell. S. Ulmifolia. S. Uspera.*)
September—October. Flowers yellow.
†angustifolia, Ell. October. Flowers yellow.
Elliottii, Tor. & Gray. September. Flowers yellow.
Boottii, Hook. September. Flowers yellow.
pilosa, Walt. (*S. pyramidata.*)
September—October. Flowers yellow.
puberula, Nutt. September. Flowers yellow.
var. pulverulenta. September. Flowers yellow.
petiolaris, Ait. September. Flowers yellow.
virgata, Michx. (*Syn. S. stricta.* Gray's Flora No. Am., Vol. I, Part II, p. 150.) September. Flowers yellow.

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*S. pilosa, S. recurvata, all synonymous with S. rugosa. See Gray's Flora No. Am., Vol. I, Part II, p. 153.

†Var. S. stricta. Gray's Flora of No. Am. Vol. I, Part II, p. 150.

***Sonchus** OLERACEUS, **L.** (SOW-THISTLE.) Introduced.
June—August. Flowers yellow.

Vernonia angustifolia, Michx. June—August. Flowers purple.

Novæboracensis, Willd. (IRON-WEED.)
July—September. Flowers purple.

Xanthium STRUMARIUM, **L.** (COCKLE-BUR.) July—September.

SPINOSUM, L. (THORNY COCKLE-BUR.) August—September.

Conoclinium cœlestinum, D. C. (MIST-FLOWER.
September. Flowers blueish purple.

Seriocarpus conyzoides, Nees. (WHITE-TOPPED ASTER.)
(*Aster conyzoides.*) August. Disk flowers yellow.

solidagineus, Nees. (*Aster solidaginoides.*)
August. Disk flowers yellow.

tortifolius, Nees. (RATTLESNAKE'S MASTER.)
August. Disk flowers yellow.

Acanthospermum XANTHIOIDES, **D. C.**
Streets of Wilmington. Introduced since 1868. Nat. from So. Am. July—August. Flowers yellowish.

Pluchea bifrons, D. C. (*Conyza bifrons, Ell.*) MARSH FLEABANE.)
September. Flowers purplish.

fœtida, D. C. (STINKING FLEABANE.) [*C. Marilandica, Ell.*]
September. Flowers purple.

camphorata, D. C. September. Flowers light purple.

Tanacetum VULGARE, **L.** (TANSY.) Introduced. About settlements.
June—July. Flowers yellow.

Artemisia caudata, Michx. (WILD WORMWOOD.) September.

Mulgedium acuminatum, D. C. (BLUE LETTUCE.) [*Sonchus Ell.*]
September. Flowers blue.

Spilanthes repens, Michx. Near Wilmington. August. Flowers yellow.

LOBELIACEÆ. (LOBELIA FAMILY.)

Lobelia cardinalis, L. (CARDINAL FLOWER.) Rice fields and river swamps.
July—October. Flowers scarlet.

Nuttallii, R. & S. (*L. Kalmii, Ell.*)
August—September. Flowers pale blue.

puberula, Michx. (BLUE LOBELIA.)
August—September. Flowers bright blue.

syphilitica, L. (GREAT LOBELIA.)
August—September. Flowers light blue.

Canbyi, Gray.

paludosa, Nutt. May—August. Flowers white or pale blue.

glandulosa, Walt. October. Flowers pale blue.

amœna, Michx. September—October. Flowers bright blue.

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*S. acuminatus and S. Carolinianus are not retained in Curtis' "Catalogue of Indig. Plants." See p. 34.

CAMPANULACEÆ. (CAMPANULA FAMILY.)

Campanula Americana, L. (Bell-flower.)
August—September. Flowers blue.

ERICACEÆ. (HEATH FAMILY.)

Gaylussacia frondosa, Tor. & Gray. (Blue Huckleberry.)
(*Vaccinium frondosa.*) April. Flowers white or reddish.
dumosa, T. & G. (Dwarf Huckleberry.) [*V. dumosa.*]
April—May. Flowers white.
var. hirtella. April—May. Flowers white.
Vaccinium corymbosum, L. (Swamp Huckleberry.) Common.
February—April. Flowers white.
tenellum, Ait. April. Flowers white.
arboreum, Mich. (Sparkle berry.) May. Flowers white.
stamineum, L. (Deerberry. Gooseberry.)
May—June. Flowers whitish.
myrsinites, Mich. Pine barrens. March—April. Flowers white.
crassifolium, And. (Creeping Huckleberry.)
Common moist sandy savannahs and pine woods.
February—March. Flowers white or rose color.
Epigea repens, L. (Trailing Arbutus. Crocus.)
Sand hills, half hidden under leaves of scrub oak.
February—March. Flowers white or rose color.
Gaultheria procumbens, L. (Mountain Tea. Winter green.)
June. Flowers white.
Leucothœ axillaris, Don. (*Andromeda axillaris, Lam.*)
February—March. Flowers white.
racemosa. (*A. racemosa, L.*) April—May. Flowers white.
Cassandra calyculata, Don. (*A. calyculata, L.*) April. Flowers white.
Andromeda nitida, Bartram. (Fetter bush.)
March—May. Flowers white, red or purple.
Mariana, L. (Stagger Bush.) April—May. Flowers white.
speciosa, Mich. May. Flowers white.
ligustrina, Muhl. (Pepper bush.) (*A. paniculata.*)
May. Flowers white.
Oxydendrum arboreum, D. C. (Sour wood. Sorrell tree.)
April—May. Flowers white.
Clethra alnifolia, L. (White Alder. Sweet pepper bush.)
May—October. Flowers white.
var. tomentosa. May—October. Flowers white.
Kalmia latifolia, L. (Ivy.) Dr. McRee. Rocky Point.
May—June. Flowers white to deep rose color.
augustifolia, L. (Wicky.) May—October. Flowers rose red.
cuneata, Mich. Flowers white.

Azalea nudiflora, L. (PURPLE HONEYSUCKLE.) Savannahs. Common. April. Flowers white varying to rose color.

viscosa, L. (CLAMMY HONEYSUCKLE.) July—August. Flowers white.

Leiophyllum buxifolium, Ell. (SAND MYRTLE.) Brunswick county. May. Flowers white.

Pyrola rotundifolia, L. (FALSE WINTER GREEN.) June—July. Flowers white.

Chimaphila umbellata, Nutt. (PRINCE'S PINE. PIPSISSEWA.) June. Flowers white.

maculata, Pursh. (SPOTTED WINTER GREEN.) June. Flowers white.

Monotropa uniflora, S. (EYE-BRIGHT. INDIAN PIPE.) August—September. Flowers white.

AQUIFOLIACEÆ. (HOLLY FAMILY.)

Ilex opaca, Ait. (HOLLY.) April—May. Flowers white.

verticillata, Gray. April. Flowers white.

Dahoon, Walt. var. myrtifolia, Chap. (DAHOON HOLLY.) April—May. Flowers white.

Cassine, L [16] (YAUPON.) [*I. vomitoria.*] Found near Wilmington Dec., 1884, with yellow berries. April. Flowers white.

glabra, Gray. (GALLBERRY. INKBERRY.) May. Flowers white.

coriacea, Chap. (TALL GALLBERRY.) May. Flowers white.

STYRACACEÆ. (STORAX FAMILY.)

Styrax grandifolia, Ait. (MOCK ORANGE.) April—May. Flowers white.

Americana, Lam. (*S. glabrum, Ell.*) May. Flowers white.

Halesia tetraptera, L. (SNOW-DROP TREE.) March—April. Flowers white.

Symplocos tinctoria, L'Her. (YELLOW WOOD. SWEET LEAF.) [*Hopea tinctoria.*] March. Flowers yellow.

CYRILLACEÆ. (CYRILLA FAMILY.)

Cyrilla racemiflora, Walt. (BURN-WOOD BARK. HE HUCKLEBERRY.) July. White flowers.

EBENACEÆ. (EBONY FAMILY.)

Diospyros Virginiana, L. (PERSIMMON.) May—June. Flowers greenish.

SAPOTACEÆ. (SAPODILLA FAMILY.)

Bumelia lycioides, Gært. (CAROLINA BUCKTHORN.)
Fruits September. Fruit a fleshy berry ovoid-black.
June—July. Flowers greenish.

PLANTAGINACEÆ. (PLANTAIN FAMILY.)

Plantago MAJOR, **L.** (PLANTAIN.) Introduced.
May—August. Flowers white.
LANCEOLATA, L. (NARROW LEAVED PLANTAIN.)
May—August. Flowers white.
Virginica, L. April—June.
sparsiflora, Mich. (*P. interrupta, Lam.*) June—September.

PLUMBAGINACEÆ. (LEADWORT FAMILY.)

Statice Caroliniana, Walt. (MARSH ROSEMARY.) [*S. limonium.*]
August—September. Flowers blue.

PRIMULACEÆ. (PRIMROSE FAMILY.)

Lysimachia stricta, Ait. (LOOSE STRIFE.) Walker's causeway.
July. Flowers yellow.
ciliata, L. Dr. McRee. Rocky Point,
July—August. Flowers yellow.
Anagallis ARVENSIS, **L.** Introduced. Rare. July. Flowers red.
Samolus floribundus, Kunth. (BROOK-WEED.) [*S. valerandi.*]
May—July.
valerandi var. Americana,* W. M. C. Fort Fisher.

LENTIBULACEÆ. (BLADDERWORT FAMILY.)

Utricularia inflata, Walt. (BLADDERWORT.)
April—May. Flowers yellow.
striata, LeConte. September. Flowers yellow.
fibrosa, Walt. [*M. longirootris, LeConte.*]
May—June. Flowers yellow.
cornuta, Mich. [*M. personata, LeConte.*]
July—September. Flowers yellow.
permeata,* LeConte. Ger. McCarthy, near McIlhenny's mill pond.
August. Flowers yellow.
subulata, L. [*M. Setacea, Michx.*] February—May. Flowers yellow.
personata,* Vahl. Ger. McCarthy.
purpurea, Walt. June. Flowers purple.

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*Not given in Curtis' Catalogue.

Pinguicula lutea, Walt. (BUTTERWORT.)
February—April. Flowers yellow.

elatior, Michx. March—April. Flowers purple to white.

pumila,* Michx. McIlhenny's pond.
March—April. Flowers purple to white.

BIGNONIACEÆ. (BIGNONIA FAMILY.)

Bignonia Capreolata, L. (CROSS-VINE.) April. Flowers red.

Tecoma radicans, Jussieux. (TRUMPET-FLOWER.) [*B. radicans.*]
May—June. Flowers scarlet.

Catalpa BIGNONIOIDES, **Walt.** (CATALPA.) Introduced.
May. Flowers white.

Martynia PROBOSCIDEA, **Glox.** (MARTINO. UNICORN PLANT.)
June—August. Flowers white.

OROBANCHACEÆ. (BROOM-ROPE FAMILY.)

Epiphegus Virginiana, Bartram. (BEECH-DROPS.) Rev. Mr. Hunt.
August. Flowers purplish.

Conopholis Americana, Wall'r. (SQUAW-ROOT.)
Dr. McRee. Rocky Point. [*Orobranche Americana.*]
April. Flowers yellowish.

SCROPHULARIACEÆ. (FIGWORT FAMILY.)

Verbascum THAPSUS, **L.** (MULLEIN.) Introduced.
May—August. Flowers yellow.

BLATTARIA, L. (MOTH MULLEIN.) May—August. Flowers yellow.

Scrophularia nodosa, L. (FIG WORT.) [*S. Marilandica, L.*]
September. Greenish purple.

Chelone glabra, L. (SNAKE-MOUTH.) July. Flowers white or rose color.

†var. purpurea. July. Flowers purple.

Pentstemon pubescens, Soland. (BEARD-TONGUE.)
June—July. Flowers purple.

var. lævigatus. June—July. Flowers purple.

Linaria Canadensis, Spreng. (TOAD FLAX.) [*Antirrhinum Canadense, L.*]
April.—May. Flowers blue and white.

SPURIA, L. Introduced.

Mimulus ringens, L. (MONKEY-FLOWER.) August. Flowers showy.

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*Not given in Curtis' Catalogue.

†Not repeated in Curtis' "Catalogue Indig. Plants."

Herpestis nigrescens, Benth. [*Gratiola acuminata, Walt.*]
August—September. Flowers striped with blue.

Monnieria, H. B. & K. (*H. cuneifolia.*) Fort Fisher.
June—September. Flowers white or pale blue.

amplexicaulis, Pursh. July—September. Flowers blue.

Gratiola Virginiana, L. (HEDGE HYSSOP.) April—May. Flowers white.

spærocarpa, Ell. (*G. Caroliana.*) March—May. Flowers white.

pilosa, Mich. June—August. Flowers white.

Ilysanthes gratioloides, Benth. (FALSE PIMPERNEL.)
(*Lindernia attenuata. Gratiola tetragona.*)
May—September. Flowers small, purplish.

Micranthemum orbiculatum, Mich. June—October. Flowers white.

Veronica ARVENSIS, **L.** (CORN SPEEDWELL.)
May—June. Flowers pale blue.

peregrina, L. (PURSLANE SPEEDWELL.)
April—June. Flowers white.

serpyllifolia, L. (PAUL'S BOTANY.) May—September. Flowers blue.

Seymeria tenuifolia, Pursh. August—September. Flowers yellow.

Dasystoma pubescens, Benth. (FALSE FOXGLOVE.) (*Gerardia flava, L.*)
July—September. Flowers yellow.

pectinata, Benth. (*G. pectinata.*)
August—September. Flowers yellow.

Gerardia linifolia, Nutt. (FLAX-LEAVED GERARDIA.)
September. Flowers purple.

aphylla, Nutt. September. Flowers purple.

divaricata, Chap. September. Flowers purple.

purpurea, L. (PURPLE GERARDIA.) September. Flowers purple.

var. fasciculata. September. Flowers purple.

maritima, Raf. Sea beach. September. Flowers purple.

tenuifolia, Vahl. September. Flowers purple.

setacea, Ell. (*G. Plunkettii, Ell.*) September. Flowers purple.

Schwalbea Americana, L. (CHAFF-SEED.)
May—June. Flowers yellow and purple.

ACANTHACEÆ. (ACANTHUS FAMILY.)

Dipteracanthus strepens, Nees. (*Ruellia strepens, L.*)
June—September. Flowers blue or purple.

Dianthera ovata, Walt. (WATER WILLOW.) (*Justicia humilis.*)
July—August. Flowers pale blue

VERBENACEÆ. (VERVAIN FAMILY.)

Verbena Caroliniana, Michx. August. Flowers pink.

OFFICINALIS, L. (VERVAIN.) Introduced. (*V. spuria, L.*)
July—August. Flowers purple.

urticifolia, L. (WHITE VERVAIN.) Rocky Point. Dr. McRee.
August—October. Flowers white or pale blue.

Lippia nodiflora, Michx. (FOG-FRUIT.) (*Zapania nodiflora, Lam.*)
May—September. Flowers white or purple.

Callicarpa Americana, L (BERMUDA MULBERRY.)
June—July. Flowers blue.

LABIATÆ. (MINT FAMILY.)

Hyptis radiata, Willd. July—September. Flowers white.

Mentha VIRIDIS, **L.** (SPEARMINT.) Introduced. (*M. tenuis, Michx.*)
July—September. Flowers pale blue.

PIPERITA, L. (PEPPERMINT.) Introduced.
July—September. Flowers white or blue.

ROTUNDIFOLIA, L. (ROUND-LEAVED MINT.) Rare.
Causeway Kidder's rice field. Wharves. July. Flowers white.

Lycopus Virginicus, L. (BUGLE-WEED.) September. Flowers white.

sinuatus, Ell. (*L. exaltatus, Ell*) July.

Pycnanthemum aristatum, Michx. August—September. Flowers white.

incanum, Michx. (MOUNTAIN MINT.)
August—September. Flowers white.

linifolium, Pursh. Rocky Point. Dr. McRee.
August—September.

Collinsonia punctata, Ell. September. Flowers yellowish.

Calamintha NEPETA, **Link.** Common about the streets. Introduced.
July—September. Flowers purple.

Salvia lyrata, L. April—May. Flowers blue.

Monarda punctata, L (RIGNUM.)
August—October. Flowers yellowish with purple bracts.

Nepeta CATARIA, **L.** (CATNIP.) Introduced
July—September. Flowers white.

Scutellaria integrifolia, L. May—July. Flowers blue.

pilosa Michx. July—August. Flowers pale blue.

nervosa,* Pursh. Ger. McCarthy. July.

serrata, Andr. July. Flowers blue.

Macbridea pulchra, Ell. Rare. Point Peter causeway.
August—September. Flowers purple.

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*Not given in Curtis' Catalogue.

Physostegia Virginiana, Benth. (DRAGON-HEAD.)
(*Dracocephalum obovatum, Ell.*)
June—August. Flowers purplish.

Lamium AMPLEXICAULE, **L.** (DEAD-NETTLE HEN-BIT.) Introduced.
Common in gardens, fields and highways. May. Flowers purple.

Marrubium VULGARE, **L.** (HOREHOUND.) Introduced.
July—September. Flowers white.

Leonurus CARDIACA, **L.** (MOTHER-WORT.) Introduced.

Stachys hyssopifolia, Mich. (HEDGE-NETTLE.)
June—August. Flowers violet.

Trichostema dichotomum, L. (BLUE-CURLS.)
August—September. Flowers blue.

Teucrium Canadense, L. (WOOD-SAGE.)
July—September. Flowers purplish.

BORRAGINACEÆ. (BORAGE FAMILY.)

Heliotropium Curassavicum, L. (HELIOTROPE.) Near the coast.
June August. Flowers white.

EUROPEUM, L.* G. McCarthy. July.

Onosmodium Virginianum, D. C. (*O. hispidum, Michx.*)
May—June. Flowers greenish.

Heliophytum INDICUM, **D. C.** (*Heliotropum Indicum.*)
(INDIAN HELIOTROPE.)* Introduced.
June—October. Flowers blue.

Lithospermum ARVENSE, **L.** (CORN GROMWELL.) Belvidere.
May—April. Flowers yellowish white.

Echium VULGARE, **L.** (BLUEWEED. VIPER'S BUGLOSS.)
Common in streets, gardens and waste places.
June—September. Flowers blue or purple.

HYDROPHYLLACEÆ. (WATER-LEAF FAMILY.)

Phacelia parviflora, Pursh. April—May. Flowers pale blue or white.

HYDROLEACEÆ. (HYDROLEA FAMILY.)

Hydrolea quadrivalvis, Walt. July—August. Flowers blue.

POLEMONIACEÆ. (POLEMONIUM FAMILY.)

†**Phlox paniculata, L.** (PHLOX.) Near Eden's Mills. Common in streets.
June—July. Flowers purple or white.

‡**subulata, L.** (WILD PINK.) April—May. Flowers purple or white.

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*Not given in Curtis' Catalogue.

†Phlox paniculata is put down in Curtis' "Catalogue of Indig. Plants" as found in Lincoln county and westward.

‡P. setacea is the same as P. subulata.

Pyxidanthera barbulata, Mich. (FLOWERING MOSS.)
Common in savannahs. [*Diapensia barbulata, Ell.*]
March—April. Flowers white.

CONVOLVULACEÆ. (CONVOLVULUS FAMILY.)

Quamoclit COCCINEA, **Mœnch.** (CYPRESS VINE.)
Common in cultivated grounds.
July—August. Flowers sometimes yellowish scarlet.

Pharbitis NIL, **Chois.** (MORNING GLORY.)
July—September. Flowers purple.

Ipomœa commutata, R. & S. (*I. trichocarpa, Ell.*)
August—October. Flowers purple.

pandurata, Meyer. (WILD POTATO.)
August—October. Flowers white.

sagittifolia, Bot. Reg. (*Convolvulus sagittifolius, Michx.*)
Smithville. July—September. Flowers purple.

lacunosa, L. August—October. Flowers white.

Calystegia PARADOXA, **Pursh.** Flowers white.

Stylisma humistrata, Chap. (*Convolvulus tenellus, Ell.*)
July—September. Flowers white.

aquatica, Chap. July—September. Flowers purple.

Pickeringii, Gray. July—September. Flowers white.

Dichondra repens, Forster. var. Caroliniensis, Chois.
March—October. Flowers greenish white.

Cuscuta arvensis, Beyr. (LOVE VINE DODDER.)
June—July. Flowers yellowish.

Gronovii, Willd. (*C. Americana, Pursh, D. C.*)
August—September. Flowers white.

compacta, Juss. July—October. Flowers whitish.

SOLANACEÆ. (NIGHTSHADE FAMILY.)

Solanum nigrum, L. (NIGHTSHADE.) Common near settlements.
July—September. Flowers white.

Carolinense, L. (HORSE-NETTLE.)
June—September. Flowers blue or white.

Physalis viscosa, L. (GROUND CHERRY.) July—October. Flowers yellow.

lanceolata, Michx. On the coast.
July—October. Flowers yellow in the throat.

angulata, L. Waste grounds. July—October. Flowers yellow.

pubescens, L. Waste grounds.
July—October. Flowers bright yellow.

Datura STRAMONIUM. (JAMESTOWN-WEED. JIMSON-WEED.)
June—October. Flowers white.

var. Tatula. Flowers purplish.

QUERCIFOLIA, H. B. K. Ballast. August. Flowers white.

METEL, L. Lower District. Dr. McRee. Causeway.
July. Flowers white.

WRIGHTII. Escaped from cultivation. Smithville.
July. Flowers white.

Petunia ——. Found in dumping grounds. Escaped from cultivation.
July. Flowers white.

GENTIANACEÆ. (GENTIAN FAMILY.)

Sabbatia angularis, Pursh. (CENTAURY.) Savannas.
July—August. Flowers purple.

brachiata, Ell. July—August. Flowers purple.

calycosa, Pursh. July—August. Flowers white.

paniculata, Pursh.
August. Flowers reddish, margins of petals and throat of corolla sometimes distinctive pink.

gentianoides, Ell. July—August. Flowers purple.

stellaris, Pursh. Salt marshes. August—September. Flowers white.

Gentiana Elliottii, Chap. (SAMPSON SNAKE-ROOT.)
October. Flowers bright blue.

Saponaria, L. (SAMPSON SNAKE-ROOT.)
September—October. Flowers light blue.

angustifolia, Michx. (NARROW-LEAVED GENTIAN.)
November—December. Flowers green without, white within.

Bartonia tenella, Muhl. September—October. Flowers greenish white.

verna, Muhl. (*Centaurella verna, Michx.*) Moist sandy places.
February—April.

Obolaria Virginica, L. Rocky Point. Dr. McRee.
March—April. Flowers purplish.

Limnanthemum lacunosum, Griseb. (FLOATING HEART.)
June—July. Flowers white.

trachyspermum, Gray. April—June. Flowers white.

APOCYNACEÆ. (DOGBANE FAMILY.)

Apocynum cannabinum, L. (INDIAN HEMP.)
Dr. McRee. Rocky Point, Masonboro Sound.
July—August. Flowers greenish white.

Forsteronia difformis, A. D. C. (*Echites difformis, Walt.*)
May—August. Flowers yellow.

Amsonia Tabernæmontana, Walt. (*A. latifolia, Michx.*)
May—June. Flowers pale blue.

ASCLEPIADACEÆ. (MILKWEED FAMILY.)

Asclepias amplexicaulis, Michx. (RABBIT'S MILK.)
April—May. Flowers ash color.

obtusifolia, Michx. June—July. Flowers greenish purple.

paupercula, Michx. June—July. Flowers deep red.

quadrifolia, Jacq. June—August. Flowers pale pink.

tuberosa, L. (BUTTERFLY-WEED. PLEURISY-ROOT.)
June—July. Flowers orange.

variegata, L. May—June. Flowers white.
verticillata, L. July—September. Flowers greenish.
incarnata, L. (SWAMP SILK-WEED.)
June—July. Flowers reddish purple.

Acerates longifolia, Ell. July. Flowers pale purple.

Podostigma pubescens, Ell. June—October. Flowers orange.

Seutera maritima, Decaisne. (*Vincetoxicum palustre.*) Salt marshes.
July—August. Flowers greenish.

Gonolobus hirsutus, Mich. (RUNNING MILK-WEED.)
September. Flowers white.
macrophyllus, Mich. July—August. Flowers purplish.

OLEACEÆ. (OLIVE FAMILY.)

Olea Americana, L. (DEVIL-WOOD. AMERICAN OLIVE.) Near the coast.
March—April. Flowers white.

Ligustrum VULGARE, **L.** (PRIVET.) Introduced. Cultivated.
May—June. Flowers white.

Chionanthus Virginica, L. (FRINGE-TREE. OLD MAN'S BEARD.)
April—May. Flowers white.

Fraxinus platycarpa, Mich. (WATER ASH.)
March—April. Flowers white.

ARISTOLOCHIACEÆ. (BIRTHWORT FAMILY.)

Aristolochia Serpentaria, L. (VIRGINIA SNAKE-ROOT.)
June.—August. Flowers dull purple.

PHYTOLACCACEÆ. (POKEWEED FAMILY.)

Phytolacca decandra, L. (POKE-WEED.)
July—September. Flowers white.

CHENOPODIACEÆ. (GOOSEFOOT FAMILY.)

Chenopodium ALBUM, **L.** (LAMB'S QUARTERS.)
July—September. Flowers greenish.
BOTRYS, L.* Ger. McCarthy. August. Flowers greenish.
ANTHELMINTICUM, L (WORM-SEED. JERUSALEM OAK.)
Introduced. August. Flowers greenish.
AMBROSIOIDES, L. August. Flowers greenish.
MURALE, L. Flowers greenish.

*Not given in Curtis' Catalogue.

Atriplex hastata, L. (ORACHE.) Sea shore. June—September.
Obione arenaria, Moq. (SAND ORACHE.) Sea beach. July—September.
Chenopodina maratima, Moq. (SEA GOOSEFOOT.) Salt marshes. September. Flowers minute.
Salicornia herbacea, L. (SAMPHIRE.) Salt marshes. August.
ambigua, Michx. Salt marshes. August.
Salsola Kali, L. (SALTWORT.) Sandy sea shore. August. Flowers rose color.

AMARANTACEÆ. (AMARANTH FAMILY.)

Amarantus HYBRIDUS, L. (GREEN AMARANTH. CARELESS.) Introduced. August—September. Flowers greenish or purplish.
SPINOSUS, L. (THORNY AMARANTH.) July—October. Flowers greenish or purplish.
CHLORASTACHYS, WILL. Cultivated ground. August—September. Flowers greenish.
Euxolus pumilus, Raf. (DWARF AMARANTH.) Sandy sea shore. August—September. Flowers greenish.
Acnida cannabina, L. (WATER HEMP.)
Telanthera polygonoides, Moq.
Alternanthera Achyrantha, R. Br. June—October.

POLYGONACEÆ. (BUCKWHEAT FAMILY.)

Polygonum ORIENTALE, L. (PRINCE'S FEATHER.) Introduced. June—September. Flowers large, bright rose color.
Pennsylvanicum, L. July—September. Flowers rose color.
PERSICARIA, L. (LADY'S THUMB.) July. Flowers rose color.
acre, Kth. (SMARTWEED.) [*P. punctatum, Ell.*] July—September.
hydropiperoides, Mich. (WATER-PEPPER.) [*P. mite, Pers.*] July—September. Flowers pale rose color.
hirsutum, Walt. July—September. Flowers white.
aviculare, L. (KNOT-GRASS.) Flowers greenish white.
setaceum, Bald.* July—September. Flowers white.
†**littorale.** [*P. Maritimum, L.*] Sea beach. Flowers reddish white.
incarnatum, Ell.* G. McCarthy. July—October. Flowers small, flesh color.
Virginianum, L. August—September. Flowers greenish.
arifolium, L. (SCRATCH-GRASS.) June—October. Flowers white.
sagittatum, L. (TEAR-THUMB.) June—October. Flowers white.

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*Not given in Curtis' Catalogue.

†See Chapman's "Flora of the Southern U. S," p. 390.

Polygonella parvifolia, Mich.
August—September. Flowers white, yellowish or rose color.
articulata, Meisn. August. Flowers bright rose color.
Rumex CRISPUS, **L.** (SOUR DOCK.) June—July.
verticillatus, L. (SWAMP DOCK.) [*R. Brittanicus, Ell.*]
May—June.
ACETOSELLA, L. (SORREL.) June—July. Flowers small.
OBTUSIFOLIUS, L. (BITTER DOCK.) July—August.
Engelmanii, Ledeb.
maritimus, L. (GOLDEN DOCK.) Sea shore. Rare.
August—September. Spikes yellowish.

LAURACEÆ (LAUREL FAMILY.)

Persea Carolinensis, Nees. (RED BAY.) [*Laurus Carolinensis, L.*]
var. palustris, M. A. C. July.
Sassafras officinale, Nees. (SASSAFRAS.) [*Laurus sassafras.*]
March. Flowers sometimes white.
Benzoin odoriferum, Nees. (SPICE-BUSH. FEVER-BUSH.)
February—March. Flowers yellow.
melissæfolium, Nees. Dr. McRee. [*L. melissæfolia. Walt.*]
February—March. Flowers yellow.
Tetranthera geniculata, Nees. (POND BUSH.
February—March. Flowers yellow.

LORANTHACEÆ. (MISTLETOE FAMILY.)

Phoradendron flavescens, Nutt. (MISTLETOE.)
[*Viscum flavescens, Pursh.*] April—May.

SAURURACEÆ. (LIZARD'S-TAIL FAMILY.)

Saururus cernuus, L. (SWAMP LILY. LIZARD'S-TAIL.)
May—August. Flowers white.

CERATOPHYLLACEÆ. (HORNWORT FAMILY.)

Ceratophyllum demersum, L. September—October.

CALLITRICHACEÆ. (WATER STARWORT FAMILY.)

Callitriche verna, L. (WATER STARWORT.) March—April.

EUPHORBIACEÆ. (SPURGE FAMILY.

Euphorbia corollata, L. (FLOWERING SPURGE.) July—September.
var. angustifolia, M. A. C. July—September.
CYPARISSIAS, L.* Advent from Europe. Ger. McCarthy.
obtusata, Pursh. (WARTED SPURGE.) May.
serpyllifolia, Pursh.* Ger. McCarthy.
cyatohphora, Jacq. Streets. May—October.
Ipecacuanhæ, L. (WILD IPECAC.) Sand hills.
May—June. Flowers not conspicuous, greenish yellow.
maculata, L. (SPOTTED SPURGE.) Common in waste grounds.
June—October.
MARGINATA, PURSH. (VARIEGATED SPURGE.)
polygonifolia, L. (SHORE SPURGE.) Sea shore. July—October.
forbuserpens, H. B. K.* Ger. McCarthy.
Curtisii, Englemann. Sea coast. August.
cordifolia, Ell. July—September.
Stillingia sylvatica, L. (QUEEN'S DELIGHT.) April—September.
ligustrina, Mich. Dr. McRee. May—August.
†**Acalypha Virginica, L.** (THREE-SEEDED MERCURY.) July—September.
gracilens, Gray. July—September.
Tragia urens, L. (NETTLE.) May—August. Flowers minute greenish.
Croton maritimum, Walt. Sea coast. July—October.
Cnidosculus stimulosus, Gray. (TREAD SOFTLY. NETTLE POTATOE.)
[*Iatropha stimulosa, Mich.*] April—September. Flowers white.
Ricinus COMMUNIS, **L.** (CASTOR-OIL PLANT.) Introduced.
June—October. Flowers yellow.

URTICACEÆ. (NETTLE FAMILY.)

Urtica URENS, **L.** (STINGING NETTLE.)
December—February. Flowers greenish.
capitata, Willd. July—August. Flowers greenish.
Pilea pumila, Gray. (CLEAR-WEED.) July—September.
Bœhmeria cylindrica, Willd. (FALSE NETTLE.) July—September.

MORACEÆ. (MULBERRY FAMILY.)

Morus rubra, L. (MULBERRY.) March.
ALBA, L. (WHITE MULBERRY.) Introduced.
Broussonetia PAPYRIFERA, **Vent.** (OTAHEITE MULBERRY.)

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*Not given in Curtis' Catalogue.

†Acalypha Caroliniana, Walt., not repeated in Curtis' "Cat. Indig. Plants."

ULMACEÆ. (ELM FAMILY.)

Ulmus Americana, L. (Elm.)
February—March. Flowers greenish or purplish.

fulva, Mich. (Slippery Elm.)
February—March. Flowers greenish or purplish.

alata, Mich. (Small-leaved Elm. Cork-winged Elm.)

Planera aquatica, Gmel. (Planer-Tree.) South of Cape Fear river.
February—March.

Celtis occidentalis, L. (Hackberry.) March. Flowers greenish.

var. pumila, M. A. C. (Dwarf Hackberry.)
March. Flowers greenish.

PLATANACEÆ. (PLANE-TREE FAMILY.)

Platanus occidentalis, L. (Sycamore.) March—April.

JUGLANDACEÆ. (WALNUT FAMILY.)

Juglans nigra, L. (Black Walnut.) March—April.

Carya tomentosa, Nutt. (White Hickory.) March—April.

amara, Nutt. (Bitter-nut Hickory.) March—April.

CUPULIFERÆ. (OAK FAMILY.)

Quercus alba, L. (White Oak.)

aquatica, Cates. (Water Oak.)

Catesbæi, Mich. (Scrub Oak.)

cinerea, var. pumila, Michx. (Running Oak. Dwarf Oak.)

lyrata, Walt. (Overcup Oak.)

coccinea, Wang. (Scarlet Oak.)

falcata, Mich. (Spanish Oak.)

nigra, L. (Black Jack.)

obtusiloba, Mich. (Post Oak.)

Phellos, L. (Willow Oak.)

Prinus, L. (Swamp Chestnut Oak.)

prinoides, Willd. (Chinquapin Oak.)

virens, Ait. (Live Oak.)

Castanea pumila. L. (Chinquapin.) April—May.

Fagus ferruginea, Ait. (Beech.) April.

Carpinus Americana, Michx. (Hornbeam.) March.

MYRICACEÆ. (WAX MYRTLE FAMILY.)

Myrica cerifera, L. (WAX MYRTLE. BAYBERRY.) Swamps. March—April.
var. pumila. Barrens. Sand hills.

BETULACEÆ. (BIRCH FAMILY.)

Betula nigra, L. (RED BIRCH.) [*B. rubra, Michx.*] March.
Alnus serrulata, Ait. (ALDER.) January—March.

SALICACEÆ. (WILLOW FAMILY.)

Salix nigra, Marshall. (BLACK OR SWAMP WILLOW.)
BABYLONICA, TOURN. (WEEPING WILLOW.) About dwellings.
Populus angulata, Ait. (CAROLINA POPLAR.) March—April.
heterophylla, L. (COTTON TREE.) March—April.
DILATATA, AIT. (LOMBARDY POPLAR.) Introduced.

CONIFERÆ. (PINE FAMILY.)

Pinus mitis, Michx. (YELLOW OR SHORT-LEAVED PINE.)
Tæda, L. (OLD FIELD, LOBLOLLY OR SLASH PINE.)
australis, Michx. (LONG-LEAF PINE.)
[*P. palustris, L.*, the prior but inappropriate name. Chapman.]
Serotina, Michx. (POND-PINE.)
Cupressus thyoides, L. (WHITE CEDAR. JUNIPER.) April.
Taxodium distichum, Rich. (CYPRESS.) [*C. distichum.*] February—March.
var. imbricaria. Cypress pond marked on Map.
Juniperus Virginiana, L. (RED CEDAR.) March.

ENDOGENS.

PALMACEÆ. (PALMS.)

Sabal Palmetto, R. & S. (PALMETTO.) Cape Fear. June.
Adansonii, Guerns. (DWARF PALMETTO.)
Eagle's Island causeway. June—July.

ARACEÆ. (ARUM FAMILY.)

Arisæma triphyllum, Torr. (INDIAN TURNIP.) March.
Xanthosoma sagittifolium, Schott. (ARROW-LEAVED SPOON FLOWER.)
"Branches" and spongy ground. Eastern side of Wilmington and Brunswick. Point Peter causeways. Fruit ripens Sept. 15 to 30. Beautiful crimson. [*Caladium glaucum*, (?) *Ell.*]
May—June. Flowers white.
Orontium aquaticum, L. (GOLDEN CLUB. WATER DOCK.)
Tuckahoe—a purely local name without any good foundation for it; probably a corruption of TUCKAW. See Kalm's Travels.
March—April.
Acorus Calamus, L. (CALAMUS.) April.

LEMNACEÆ. (DUCKWEED FAMILY.)

Lemna minor, L. (DUCKWEED.)
polyrhiza, L.

TYPHACEÆ. (CAT-TAIL FAMILY.)

Typha latifolia, L. (CAT-TAIL.) July—August.
Sparganium ramosum, Hudson. (BUR-REED.) July.

NAIADACEÆ. (POND WEED FAMILY.)

Zostera marina, L. (SEA-WRACK. EEL-GRASS.) Salt water.
August—September.
Ruppia maritima, L. (DITCH-GRASS.) May—August.
Potamogeton pectinatus, L. (PONDWEED.) June—August.
lucens, L. August.
hybridus, Michx. June—August.

heterophyllus, Schreb.	July.
pau iflorus, Pursh.	July—August.
perfoliatus, L.	July—September.
fluitans, Roth.	June—August.
Naias flexilis, Rotsk.	

ALISMACEÆ. (WATER-PLANTAIN FAMILY.)

Alisma plantago, L. (WATER-PLAINTAIN.) July—August.
Triglochin triandrum, Michx. (ARROW-GRASS.) August—September.
Echinodorus radicans, Engelmann. (*Alisma radicans, Nutt.*) July—September.
***Sagittaria variabilis, Eng.** (ARROW-LEAF.) July—September.
falcata, Pursh. June—September.
pusilla, Nutt.
heterophylla, Pursh.
natans, Michx. June—September.
simplex, Nutt. May—October.
graminea, Michx.† Ger. McCarthy.

HYROCHARIDACEÆ. (FROG'S-BIT FAMILY.)

Limnobium Spongia, Rich. (FROG'S-BIT.) July—August.

BURMANNIACEÆ. (BURMANNIA FAMILY.)

Burmannia biflora, L. October. Flowers pinkish.
capitata, Chap. (*Tripterella capitata, Michx.*) October. Flowers white.

ORCHIDACEÆ. (ORCHIS FAMILY.)

Microstylis orphioglossoides, Nutt. (ADDER'S-MOUTH.) July—August. Flowers greenish.
‡**Bletia aphylla, Nutt.** Dr. McRee. Rocky Point. July—August. Flowers brownish, striped with purple.
Ponthieva glandulosa, R. Br. (*Ophrys pubera, Michx.*) September—October. Flowers greenish.
Corallorhiza odontorhiza, Nutt. (CORAL-ROOT.) [*Cymbidium corallorhizoa.*] February—March.

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*S. variabilis variously named S. sagittifolia, hastata, pubescens, etc.

†Not given in Curtis' Catalogue.

‡A specimen found by Mr. Charlie Bradley in his boathouse at Greenville Sound, on Hewlett's Creek, 1886.

Habenaria repens, Nutt. August—September. Flowers small, greenish.
Listera australis, Lindley. (TWAYBLADE.) July. Flowers small, greenish.
Pogonia divaricata, R. Br. May. Flowers flesh-colored.
ophioglossoides, Nutt. April—May. Flowers pale rose color.
Tipularia discolor, Nutt. (CRANE-FLY ORCHIS.) August. Flowers greenish.
Platanthera flava, Gray. (YELLOW ORCHIS.) July—August. Flowers brownish green.
ciliaris, Lindley. (YELLOW FRINGED ORCHIS.) Flowers large bright yellow.
blephariglottis, Lindley. (WHITE FRINGED ORCHIS.) August. Flowers white.
Spiranthes cernua, Rich. (LADY'S TRESSES.) October. Flowers yellowish white.
odorata, Nutt. October. Flowers yellowish white.
tortilis, Willd. May. Flowers white.
gracilis, Bigelow. April—May. Flowers minute.
Epidendrum* conopseum. Major Young, Pender county, 1881. August. Flowers green, tinged with purple.
Calopogon pulchellus, R. Br. (BEARDED PINK.) June. Flowers bright purple.
parviflorus, Lindley. March—April. Flowers bright purple.
var. albus.

AMARYLLIDACEÆ. (AMARYLLIS FAMILY.)

Amaryllis Atamasco, L. (ATAMASCO LILY. STAGGER-GRASS.) March—April. Flowers white, tinged with red.
Pancratium rotatum, Ker. (*P. Mexicanum.*) April—May. Flowers white.
Hypoxis erecta, L. (YELLOW STAR-GRASS.) March—April. Flowers yellow.

HÆMODORACEÆ. (BLOODWORT FAMILY.)

Lachnanthes tinctoria, Ell. (RED-ROOT.) July—September. Flowers yellow.
Aletris farinosa, L. (STAR-GRASS. COLIC-ROOT.) May—June. Flowers white or yellow.
aurea, Walt. May—June. Flowers white or yellow.

BROMELIACEÆ. (PINE-APPLE FAMILY.)

Tillandsia usneoides, L. (LONG MOSS.) June—September. Petals green.

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*Not given in Curtis' Catalogue.

IRIDACEÆ (IRIS FAMILY.)

Iris versicolor, L. (BLUE FLAG.) April—May. Flowers pale blue.
tripetala, Walt. June—July. Flowers blue.
Virginica, L. June. Flowers blue or white.
verna, L. (DWARF IRIS.) April. Flowers pale blue.
Sisyrinchium Bermudiana, L. (BLUE-EYED GRASS. PEPPER GRASS.) July—August. Flowers blue, yellow center.

DIOSCOREACEÆ. (YAM FAMILY.)

Dioscorea villosa, L. (WILD YAM.) July. Flowers whitish.

SMILACEÆ. (SMILAX FAMILY.)

Smilax rotundifolia, L. (BAMBOO.) June. Flowers small, greenish.
tamnoides, L. May. Flowers greenish.
Pseudo-China, L. (CHINA ROOT.) April—May.
glauca, Walt. (SARSAPARILLA.) May.
Walteri, Pursh. (RED-BERRIED BAMBOO.) March—April. Flowers brownish.
lanceolata, L. August.
laurifolia, L. July—August.
auriculata, Walt. On the coast. May—June. Flowers small, very fragrant.

LILIACEÆ. (LILY FAMILY.)

Lilium Catesbæi, Walt. (SOUTHERN LILY.) August—September. Flowers scarlet, variegated with yellow and purple.
Yucca aloifolia, L. (SPANISH BAYONET.) May—June. Flowers white, tinged with purple.
gloriosa, L. Sea coast. May—June. Flowers white.
filamentosa, L. (BEAR-GRASS.) June. Flowers white, tinged with purple.
Allium VINEALE, **L.** (WILD ONION.) Introduced.
striatum, L. March—April. Flowers white.

MELANTHACEÆ. (COLCHICUM FAMILY.)

Melanthium Virginicum, L. (BUNCH-FLOWER.) July—August. Flowers cream color, turning brownish.
Zygadenus glaberrimus, Michx. June—July. Flowers white.

Tofieldia glabra, Nutt. (FALSE ASPHODEL.) October. Flowers white.
pubens, Ait. September. Flowers greenish white.
Pleea tenuifolia, Michx. Savannas near Cypress swamp, east from Wilmington. October. Flowers greenish without.

JUNCACEÆ. (RUSH FAMILY.)

Juncus effusus, L. (BOG-RUSH.) May—September. Flowers green.
setaceus, Rostk. May—July. Flowers green.
maritimus, L. Brackish marshes. (*L. acutus, Muhl.*) April—May. Flowers green.
tenuis, Willd. May—June. Flowers green.
dichotomus, Ell. May—June. Flowers green.
polycephalus, Ell. July—September. Flowers green.
paradoxus, Meyer. July—September. Flowers green.
acuminatus, Michx. July—September. Flowers green.
marginatus, Rostk. July—September. Flowers green.
Luzula campestris, D. C March—April.
Cephaloxys flabellata, Desv. (*Juncus repens, Michx.*) July. Flowers greenish.

PONTEDERIACEÆ. (PICKEREL-WEED FAMILY.)

Pontederia cordata, L. (PICKEREL-WEED.) July—September. Flowers blue.

COMMELYNACEÆ. (SPIDERWORT FAMILY.)

Commelyna communis, L. (DAY-FLOWER.) July—September. Flowers blue.
Virginica, L. May—September. Flowers blue.
erecta, L. Ger. McCarthy. August—September. Flowers blue.
Tradescantia Virginica, L. (SPIDERWORT.) Eagle's Island causeway. March—May. Flowers blue.
rosea, Vent. June—August. Flowers bright rose color.

MAYACACEÆ. (MAYACA FAMILY.)

Mayaca Michauxii, S. & E. Found at McIlhenny's mill, southern end of Wilmington, in bog by roadside. Causeway in abundance. June—October. Flowers pale pink.

XYRIDACEÆ. (YELLOW-EYED-GRASS FAMILY.)

Xyris brevifolia, Michx. (Yellow-eyed Grass.) April—May. Flowers yellow.

Caroliniana, Walt. July—August. Flowers yellow.

ambigua, Beyr. July—September. Bracts light brown.

tenuifolia, Chap. July—September. Flowers yellow.

torta, Smith. July—September. Flowers yellow.

ERIOCAULONACEÆ. (PIPEWORT FAMILY.)

Eriocaulon gnapholodes, Mich. April—May. Flowers white, densely downy.

decangulare, L. (Pipewort.) July—September.

Pæpalanthus flavidulus, Kth. (Yellow Pipewort.) April—May.

Lachnocaulon Michauxii, Kth. (Hairy Pipewort.) May—June.

CYPERACEÆ. (SEDGE GRASSES.)

Cyperus compressus, L. July—September.

diandrus, Tor. Ger. McCarthy. August.

flavescens, L. July—August.

Gatesii, Torr.

rotundus, L. (Nut-grass.) [*C. hydra.*] August—September.

var. hydra, Gray.* Ger. McCarthy. August—September.

filiculmis, Vahl. (*C. mariscoides.*) July—September.

Michauxianus, Schultes. August—September.

Nuttallii, Torr. July—September.

flavicomus, Mich.* Ger. McCarthy. May—September.

Haspan, L. July—September.

speciosus, Vahl.

retrofractus, Torr. Ger. McCarthy. July—September.

stenolepis, Torr. August—September.

Baldwinii, Torr. Ger. McCarthy. July—September.

strigosus, L. July—September.

tetragonus, Ell. August—September.

vegetus, Willd. September.

virens, Mich. July—September.

erythrorhizos, Muhl. July—September.

distans, Pursh.* Identified by Prof. Britton as a long doubted species. Ger. McCarthy, 1885.

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*Not given in Curtis' Catalogue.

Kyllingia pumila, Mich. July—September.
Lipocarpha maculata, Torr. July—September.
Dulichium spathaceum, Rich. August—September.
Fuirena squarrosa, Mich. (UMBRELLA-GRASS.) July—September.
Eleocharis equisetoides, Torrey. July—September.
cellulosa, Torr.* Ger. McCarthy. August—September.
quadrangulata. (*Scirpus quadrangulatus, Michx.*) July—September.
tuberculosa, R. Br. (*S. tuberculosus, Michx.*) March—September.
simplex, Torr. (*S. simplex, Ell.*) May—September.
prolifera, Torr. May—September.
rostellata, Torr.
melanocarpa, Torr. June—September.
olivacea, Torr. Sea coast. August—September.
microcarpa, Torr.
tricostata, Torr. May—September.
palustris, R. Br. (*S. palustris, L.*) June—September.
obtusa, Schultes. June—September.
acicularis, R. Br. June—September.
pygmæa, Torr. Near the coast. April—May.
Baldwinii, Torr. June—September.
Scirpus debilis, Pursh.
Canbyi, Gray.* Ger. McCarthy. July—August.
pungens, Vahl. (SWORD-GRASS.) Near the coast. June—September.
Olneyi, Gray. Brackish marshes. June—September.
lacustris, L. July—September.
maritimus, L. Salt marshes. August—September.
Eriaphorum, Michx July—September.
lineatus, Michx. June—August.
Eriophorum Virginicum, L. (COTTON-GRASS.) June—August.
Fimbristylis spadicea, Vahl. (*Scirpus castaneus, Michx.*) August—October.
Trichelostylis autumnalis. (*S. autumnalis, L.*) July—October.
Isolepis ciliatifolia, Torr. (*S. ciliatifolius, Ell.*) Ger. McCarthy. August—September.
stenophylla, Torr. (*S. stenophyllus, Ell.*) Ger. McCarthy. August—September.
capillaris, R. & S. (*S. capillaris, L.*) June—September.
Rhyncospora plumosa, Ell. (TICK-SEED GRASS.) June—July.
corniculata, Gray,* Ger. McCarthy.
oligantha, Gray. June—July.
rariflora, Ell. June—July.
Torreyana, Gray. July.
microcarpa, Baldwin. July—August.

*Not given in Curtis' Catalogue.

inexpansa, Vahl.	July—August.
caduca, Ell.	August.
miliacea, Gray.	June—July.
Grayii, Kth	June—July.
megalocarpa, Gray.	May—August.
Baldwinii, Gray.	June—July.
ciliata, Vahl.	June—August.
fascicularis, Nutt.	June—July.
var. distans.	August—September.
filifolia, Gray.	July—August.
pallida, M. A. C.	June.
alba, Vahl.	August—September.
cephalantha, Gray.	July—August.
Chapmanii, M. A. C.	July—August.
Ceratoschœnus macrostachyus, Gray. (HORNED RUSH.)	August.
corniculatus, Nees.	July—September.
Psilocarya rhynchosporoides, Torr. (BALD RUSH.)	July.
Cladium effusum, Torr. (SAW-GRASS.) [*Schœnus effusus, Swartz.*]	July—August.
mariscoides, Torr. (TWIG-RUSH.) [*S. mariscoides.*]	
Dichromena latifolia, Bald.	May—July.
leucocephala, Michx.	August—September.
Scleria triglomerata, Michx. (NUT-RUSH.)	June—August.
laxa, Torr.	August—October.
Carex bromoides, Schk. (SEDGE GRASS.)	March—April.
stipata, Muhl.	April—May.
Muhlenbergii, Schk.	
stellulata, Good.	
straminea, Schk.	
fœnea, Muhl.	
crinita, Lam.	
polytrichoides, Muhl.	
granularis, Muhl.	
glaucescens, Ell.	July—August.
verrucosa, Ell.	
lupulina, Muhl.	July—August.
turgescens, Torr.	
Elliottii, Schw. & Torr.	
riparia, M. A. C.	
stricta, Good. (*C. acuta, Ell.*)	
laxiflora, Lam. (*C. anceps, Willd.*)	
debilis, Michx.	
vulpinoidea, Michx. *C. multiflora, Muhl.*)	July—August.

*retroflexa, Muhl.
tentaculata, Muhl.
†triceps, Michx.
*virescens.
folliculata, L. (*C. Xanthophysa, Wahl.*)

GRAMINEÆ. (GRASSES.)

Leersia oryzoides, Swartz. (RICE GRASS. FALSE GRASS.) July—August.
Virginica, Willd. July—August.
hexandra,‡ Eagles' Island causeway. Ger. McCarthy. July—August.
Zizania aquatica, L. (WILD RICE.) July.
miliacea, Michx. (WILD OATS.) April—May.
Hydrochloa Carolinensis, Beauv. (*H. fluitans.*) July—August.
Alopecurus GENICULATUS, **L.** (FLOATING FOX-TAIL.) Introduced. April.
Polypogon MARITIMUS, **Willd.** (BEARD-GRASS.) Sea coast.
Sporobolus junceus, Kth. (WIRE-GRASS.) April—May, often October.
Floridanus, Chap.§ Ger. McCarthy. September.
INDICUS, BR. May—September.
Vilfa aspera, Beauv. (*Sporobolus asper, Kth., Agrostis clandestina, Spreng.*) July—August.
Agrostis ALBA, **L.** (BENT-GRASS. HERD'S GRASS.) [*A. vulgaris, With., var. alba, Vasey.*] Introduced.
elata, Trin. (TALL THIN-GRASS.) September.
scabra, Willd. (HAIR-GRASS.) [*Trichodium laxifolium, Ell.*] June—July.
verticiliata.§ G. McCarthy.
perennans, Tuck. (THIN-GRASS.) [*T. perennans, Ell.*] July—August.
Cinna arundinacea, L. (WOOD REED-GRASS.)
Muhlenbergia diffusa, Schreb. (NIMBLE WILL.) August—September.
capillaris, Kth. (HAIR-GRASS.) Near the coast.
Calamagrostis coarctata, Torr. (REED. BENT-GRASS. WILD OATS.) [*Deyeuxia Nuttalliana, Vasey. C. Nuttalliana, Steud.*] August—September.
arenaria, Roth. (*Ammophila arundinacea, Host.*) Sea beach. August.
Stipa avenacea, L. (FEATHER-GRASS.) April.

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*Is assigned in CATALOGUE to the "mountains."

†Is assigned in CATALOGUE to "Middle District."

‡Not given in Catalogue. Possibly introduced from Florida or Gulf region.

§Not given in Curtis' Catalogue.

Aristida lanata, Poir. (THREE-AWNED GRASS.) July—August.
purpurascens, Poir. August.
stricta, Michx. (WIRE-GRASS.) June—July.
gracilis, Ell. August.
virgata, Trinius.
spiciformis, Ell. August.
oligantha, Michx. September.
Spartina juncea, Willd. Sea coast. July—August.
cynosuroides, Willd.* Ger. McCarthy. July—August.
polystachya, Willd. August—September.
glabra, Muhl. (MARSH GRASS.) Salt marsh. August—September.
Gymnopogon racemosus, Beauv. September—October.
Eustachys petræa, Desv. Sea coast. May—August.
Cynodon DACTYLON, **Pers.** (BERMUDA GRASS. REED GRASS. CANE GRASS.)
Ctenium americanum, Spreng. (LEMON GRASS.) Savannas. July—August.
Dactyloctenium ÆGYPTIACUM, **Willd.** (EGYPTIAN GRASS.) [*Eleusine* (?) *cruciata*, *Ell.*, *E. Ægyptiaca*, *Pers.*]
Eleusine INDICA, **Gært.** (GOOSE-GRASS.)
Leptochloa polystachya, Kth. Brackish marshes. September.
Triplasis Americana, Beauv. (SAND GRASS.) [*Uralepis cornuta*, *Ell.*] August—September.
purpurea, Chap. (*U. purpurea*, *Nutt.*) August—October.
Melica mutica, Walt. (MELIC GRASS.) April.
Glyceria nervata, Trin. (*Poa parviflora*, *Pursh.*) July.
Arundinaria gigantea, Chap. (CANE.) [*A. macrosperma*, *Michx.*] February.
tecta, Muhl. (REED.) February—March.
Brizopyrum spicatum, Hook. (SPIKE-GRASS.) (*Distichlis maritima*, *Raf.* *Uniola spicata*, *Ell.*) August—September.
Poa annua, L. (SPEAR-GRASS. MAY-GRASS.) February—March.
flexuosa, Muhl. (*P. autumnalis*, *Ell.*) May.
pratensis, L. (BLUE-GRASS.) May.
compressa, L. May.
Dactylis GLOMERATA, **L.** (ORCHARD GRASS.) May—June
Eragrostis Purshii, Schrad. (*Poa tenella.*) June—September.
tenuis, Gray. (*Poa tenuis*, *Ell.*) August—September.
pectinacea, Gray. August—September
var. refracta. (*Poa refracta*, *Ell.*)
Festuca Myurus, L. (FESCUE-GRASS.) March—April.
tenella, Willd. February—April.
duriuscula, L. Sea coast. April—May.

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*Not given in Curtis' Catalogue.

ELATIOR, L.
nutans, Willd. August.
Bromus SECALINUS, **L.** Ger. McCarthy.
RACEMOSUS, L.* Ger. McCarthy.
Uniola paniculata, L. (BEACH GRASS.) July—August.
gracilis, Michx. July—August.
Hordeum pusillum, Nutt. W. M. Canby. (?)
Elymus Virginicus, L. July—August.
Trisetum palustre, Torr. March—April.
Danthonia spicata, Beauv. (WILD OAT-GRASS.) June—July.
Holcus LANATUS, **L.** (VELVET GRASS.) Introduced.
Anthoxanthum ODORATUM, **L.** (SWEET-SCENTED GRASS.) Introduced. April—May.
Phalaris intermedia, Bosc. (SOUTHERN CANARY-GRASS.) April—May.
Paspalum Walterianum, Schultes. [*P. vaginatum, Ell.*] July—August.
distichum, L. August—September.
præcox, Walt. [*P. lentiferum, Lam.*] May—June.
læve, Michx. July—August.
Floridanum, Michx. August—September.
undulatum, Poir. [*P. purpurascens, Ell.*] September.
ciliatifolium, Michx. [*P. dasphyllum, Ell.*] June—September.
Panicum SANGUINALE, **L.** (CRAB-GRASS.) [*Digitaria sanguinale, Scop.*] Introduced. May—October.
gibbum, Ell. [*P. strictum.*] July—September.
filiforme, L. [*P. striatum. Digitaria filiformis, Muhl.*] August—September.
Curtisii, Chap.
agrostoides, Spreng.* Ger. McCarthy.
hians, Ell.
colonum, L.* Ger. McCarthy.
anceps, L. August—September.
virgatum, L. August—September.
amarum, Ell. On the coast. September. Plants salt and bitter to taste.
proliferum, Lam. September.
divergens, Muhl. August.
verrucosum, Muhl. September.
scoparium, L. [*nervosum.*] May.
viscidum, Ell. May.
scabriusculum, Ell. May.
depauperatum, Muhl. June.
ignoratum, Kth. July—August.
CRUS-GALLI, L. Introduced. August—September.
var. hispidum.

*Not given in Curtis' Catalogue.

Setaria VERTICILLATA, **Beauv.** Introduced.
GLAUCA, BEAUV. (FOXTAIL.) Introduced.
var. lævigata. Ger. McCarthy.
ITALICA, KTH. (ITALIAN MILLET.) July—September.
Cenchrus tribuloides, L. (SAND-SPUR.) On the coast. July—October.
MYOSUROIDES, H. B. K.* Ger. McCarthy. Ballast heap. West Indies.
Stenotaphrum* Americanum, Schrank. June—September.
Tripsacum dactyloides, L. (GAMA-GRASS.) August—September. June 20th, 1886.
Andropogon scoparius, Michx. (BROOM-GRASS.) August—September.
furcatus, Muhl. (*A. provincialis, Lam.*) September.
tetrastachyus, Ell. (*A. dissitiflorus, Michx. var. tetrastachyus, Hack.*) September.
Virginicus, L. (*A. dissitiflorus, Michx.*) September—October.
var. vaginatus.
macrourus, Michx. September.
Elliottii, Chap. September—October.
Erianthus alopecuroides, Ell. (*E. saccharoides, Michx.*) September—October.
contortus, Ell.* Ger. McCarthy.
Sorghum avenaceum, Chap. (INDIAN GRASS.) [*Chrysopogon avenaceum, Benth., Andropogan avenaceus, Michx., A. ciliatus, Ell.*] September.
SACCHARATUM, PERS.* Ger. McCarthy.
HALAPENSE, PERS. (CUBA GRASS. MAIDEN CANE.)
nutans, Gray. (WOOD-GRASS.) [*Chrysopogon nutans, Benth., Andropogan nutans, L.*] September.
Lapago RACEMOSA. Ger. McCarthy.

FLOWERLESS PLANTS.

FILICES. (FERNS.)

Polypodium incanum, Swartz. (TREE POLYPODIUM.)
Pteris aquilina, L. (BRAKE.)
Adiantum, Capillus-Veneris, L. (MAIDEN'S HAIR FERN.) Found by Mr. W. M. Canby, at Hilton, 1868.
Woodwardia angustifolia, Smith.
Virginica, Willd. (*W. onocleoides, Willd.*)
Asplenium ebeneum, Ait.
Onoclea sensibilis, L. (SENSITIVE FERN.)

*Not given in Curtis' Catalogue.

Lygodium polmatum, Swartz. (CLIMBING FERN.)
Found in Holly Shelter swamp, 1879, by Maj. W. L. Young.

Osmunda regalis, L. (FLOWERING FERN.)
cinnamonea, L.

Botrychium lunarioides, Swartz.

LYCOPODIACEÆ. (CLUBMOSS FAMILY.)

Lycopodium alopecuroides, L.
Carolinianum, L.

Selaginella rupestris, Spreng.

HYDROPTERIDES. (WATER FERN FAMILY.)

Azolla Caroliniana, Willd.

NOTES OF THE BALLAST PLANTS.

BY GERALD MCCARTHY.

Ranunculus philonotis is from southern Europe. Also found at Philadelphia by Mr. Martindale.

Schizandra coccinea is West Indian and Mexican, new to this country.

Scolymus Hispanicus is West Indian—new.

Tribulus terrestris is West Indian and also occurs in Southern Russia. Adventive at Philadelphia. Martindale.

Erodium cicutarium is European—new.

Linaria spuria is European—new.

Heliotropium Europæum is European—new. Adventive in many places.

Datura mercifolium is West Indian and Mexican—new to this country.

Boerhaavia viscosa is West Indian and Mexican—new to this country.

Alternanthera achyrantha is West Indian and Mexican—new to this country. This plant is not a ballast plant but was found by me along the W. C. & A. R. R. in Columbus county, near Whiteville.

Euphorbia Cyparissias is European—new to this country.

Cyperus distans is an indigenous plant, but extremely interesting, having been found before by but one collector, Fred. K. Pursh.

Cyperus papyrus is the Egyptian paper reed, came probably from Sicily, where it grows abundantly.

Panicum colonum is European, and new to this country.

Cenchrus myosuroides is West Indian and Mexican, and new to this country, except the southern extremity of Florida.

Lapago racemosa is West Indian and Mexican, new to this country.

NUMERICAL STATEMENT OF GENERA, SPECIES AND VARIETIES, INCLUDED IN THE CATALOGUE.

PHÆNOGAMIA.*

Genera included in the Catalogue		527
Species supposed to be indigenous to the Wilmington Flora	1046	
Species regarded as introduced	122	
Total number of species		1168
Varieties indigenous and introduced		34
Total number of species and varieties		1202

These arranged systematically are distributed as follows:

Exogens	104 orders,	402 genera,	861 species and varieties.	
Endogens	25 "	125 "	341 "	"
Total Phænogamia	129 "	527 "	1202 "	"

COMPOSITION OF THE LARGER ORDERS.

FIGURES IN PARENTHESES REPRESENT INTRODUCED SPECIES.

ORDER.	GENERA.	SPECIES.		SPECIES AND VARIETIES.
Compositæ	56	(9)	142	146
Gramineæ	49	(22)	118	121
Cyperaceæ	18		106	108
Leguminosæ	33	(12)	80	87
Scrophulariaceæ	16	(4)	31	34
Ericaceæ	15		29	31
Rosaceæ	11	(4)	28	28
Labiatæ	18	(8)	25	25
Onagraceæ	6		21	22
Umbelliferæ	12	(1)	22	22
Orchidaceæ	12		19	20
Caryophyllaceæ	13	(6)	19	19
Ranunculaceæ	6	(1)	16	17
Rubiaceæ	9		16	17
Cruciferæ	7	(3)	11	11

*This enumeration does not include the partial list of ballast plants given on page 134.

NUMBER OF SPECIES IN THE LARGER GENERA.

FIGURES IN PARENTHESES REPRESENT INTRODUCED SPECIES.

Carex		24	Ludwigia	11
Cyperus		20	Eupatorium	10
Rhyncospora		19	Hypericum	10
Panicum	(2)	19	Polygala	10
Solidago		16	Juncus	9
Aster	(1)	16	Coreopsis	8
Eleocharis		16	Lobelia	8
Polygonum		13	Utricularia	8
Desmodium		12	Asclepias	8
Euphorbia	(2)	12	Scirpus	8
Quercus		12	Smilax	8

Of varieties the catalogue gives two to Solidago, and one each to Cyperus, Rhyncospora, Euphorbia and Quercus of the above list.

CRYPTOGAMIA.

ORDER.	GENERA.	SPECIES.
Filices	9	11
Lycopodiaceæ	2	3
Hydropterides	1	1

Errata.

Page 77, line 26 from bottom, in place of "1832" read "1834."
" 85, line 5 from top, the generic name "Sarracenia" is accidentally repeated.
" 85, "Cakile maratima" should be "Cakile maritima."
" 90, the generic name "Hibiscus" is accidentally repeated.
" 92, line 5, the generic name "Rhus" is accidentally repeated.
" 92, line 6 from the bottom, "STAPHYLLACEÆ" should be "STAPHYLEACEÆ."
" 93, "Cassia Marylandica" should be "Cassia Marilandica."
" 94, "Lathyrus paluster" should be "Lathyrus palustris."
" 95, "Styloshanthes" should be "Stylosanthes."
" 96, "Petalastemon" should be "Petalostemon."
" 100, "Sanicula Marylandica" should be "Sanicula Marilandica."
" 104, in note †, at bottom of page, "steets" should be "streets."
" 107, "Leucothœ" should be "Leucothoë."
" 110, "BROOM-ROPE FAMILY" should be "BROOM-RAPE FAMILY."
" 111, "Gratiola spærocarpa" should be "Gratiola sphærocarpa."
" 117, "Chenopodina maratima" should be "Chenopodina maritima."
" 134, "Lygodium polmatum" should be "Lygodium palmatum."

Index to Genera.

NOTES.

A THERMOMETER FOR CLASS ILLUSTRATION.

For lecture experiments a thermometer should be sensitive so as to show slight changes of temperature, and should make these changes readily apparent to all in the room—that is, the changes should not only be clearly visible but should be such as are commonly referred to the action of heat and used for its measurement. The ether thermometer, based on the low temperature at which ether boils, will show only an increase of temperature, and the igniting of the vapor does not point directly enough to the change to be measured. So, too, the closing of an electric current by mercury rising in a tube, and the breaking of the same by its falling, make the change of temperature very apparent but introduce too many elements of confusion.

Discarding these forms of thermometers, then, I have been using a modification of the air-thermometer which answers all the requirements. As I have seen no mention of such a thermometer in any of the ordinary books on lecture experiments, I offer a description of it to the Society for the benefit of members who have felt the need of such a thermometer and have failed, as I have, to gain any help from the usual reference books.

The construction of the thermometer is very simple. A piece of glass tubing 50—75 c. m. long and 5—10 m. m. wide is sealed at one end and an oblong bulb is then blown on it. This bulb may be larger or smaller according to the substance whose temperature is to measured. The thickness of its walls largely determine its sensitiveness. The tube is then bent four times at right angles as shown in the figure. In the open end a liquid (mercury, colored water or alcohol) is poured until it rises to any desired level. By properly moving the tube it can be gotten to the same level in both arms of the tube without getting in the bulb. It may be well to keep several such thermometers, containing different liquids, so as to have different degrees of sensitiveness.

Very slight changes of temperature can be shown by the rise or fall of the liquid, and as this is the customary mode of measuring temperature, no explanation is necessary to a class nor is confusion produced. I have found the thermometer very useful for showing such changes as those produced by adding water to sulphuric acid, calcium chloride, ammonium nitrate and many slighter changes caused by chemical reaction.

F. P. VENABLE

Chemical Laboratory, U. N. C.

SUGAR BEETS FROM KENTUCKY.

In order to test whether the sugar beet can be successfully raised in the Blue Grass region of Kentucky, a preliminary experiment was held in the summer of 1885 Seed of "Vilmorin's Improved French White Sugar Beet," from Gregory of Marblehead, was sown about the 10th of May in soil which had a number of years previously been used for garden vegetables, but which had for three years at least received no manure or fertilizer. In August they were attacked by the so-called "old fashioned" potato bug and the tops somewhat injured. They were gathered the latter part of September. The season had been in this locality very dry and warm, the mean temperature of the summer months being 2.59° warmer than that of 1884. The beets were very small from this cause, a number of selected specimens averaging 331 grams. The sugar was determined by expressing the juice, testing for reducing sugar, inverting the beet sugars and determining the invert sugar. The sugar estimations were made with Fehling's solution. The average amount of reducing sugar was 0.30 per cent. and the sucrose 10.94 per cent. of the juice. This per centage of sugar is very favorable under the circumstances, coming near to the amount which is profitable to manufacture, but the beets were small, the amount of "solid matter not sugar," large, and the amount of reducing sugar larger than it should be. How much of this was due to the unfavorable season and the lack of proper fertilizers, it is impossible to determine, and the beets must be tested another season and with other cultivation.

Prof. Wiley, of the Agricultural Department, considers that the

sugar beet will not flourish south of the isotherm of 70° mean temperature for the summer months (Bulletin 3, Chem. Div. Agric. Dept.) The mean monthly temperature for June, July and August of '84 and '85, as well as rain fall, were as follows:

	Temperature.		Rainfall.	
	'84	'85	'84	'85
June	71.77	71.8	3.21	2.45
July	72.73	76.93	6.35	2.35
August	71.28	74.84	1.74	1.9
Total	215.78	223.67	11.30	6.70
Average	71.93	74.52	3.77	2.23

It will thus be seen that last season was particularly unfavorable as regards both temperature and rainfall, and yet the juice averaged nearly 11 per cent. sugar, while the experiments at Washington gave juice of only 7.61 per cent. sugar. Further experiments will be undertaken this year on this subject.

JAS. LEWIS HOWE.

Laboratory of Central University,
Richmond, Ky., March, 1886.

LITHOGRAPHIC STONE FROM TENNESSEE.

Specimens of lithographic stone from Clay county and Overton county, Tennessee, which are claimed to be very similar to the Bavarian stone, have been analyzed with the following results:

1. Clay county, Tennessee, buff lithographic stone.

Calcium carbonate	83.36
Magnesium carbonate	10.34
Iron and aluminum oxide	.80
Silica and insoluble silicates	5.68

2. Overton county, Tennessee, blue gray lithographic stone.

Calcium carbonate	77.62
Magnesium carbonate	17.32
Iron and aluminum oxide	.66
Silica and insoluble silicates	4.10

The specific gravity of both these stones is higher than that of the Baravian. and it does not seem wholly free from crystals. The Clay county stone contains more silica than the Baravian stone, and they both contain more iron. The Overton county stone contains a much larger quantity of magnesium carbonate. For comparison, the following is an analysis of the Bavarian stone :

Calcium carbonate	81.47
Magnesium carbonate	13.83
Iron oxide	.25
Silicates	4.45

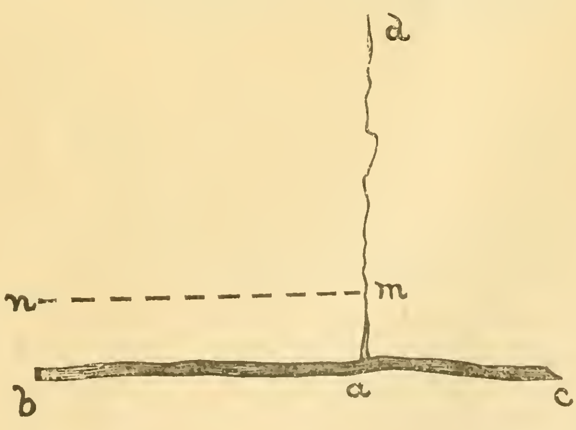
JAS. LEWIS HOWE.

Laboratory of Central University,
Richmond, Ky., March, 1886.

CYCLONES.

In the month of May I witnessed a phenomenon which may assist us in determining the cause or causes of cyclones or tornadoes, and its repeated occurrence under the same conditions impressed me with its value to the student of nature and induced the desire that a record of it be preserved.

In the *figure*, *a* is the head of a drain pretty well grown up with shrubs and trees in an old field, which supports a not very dense growth of old field pines, the dotted line *m n* being their northern border. The drain runs north, and north of the dotted line is cleared land.

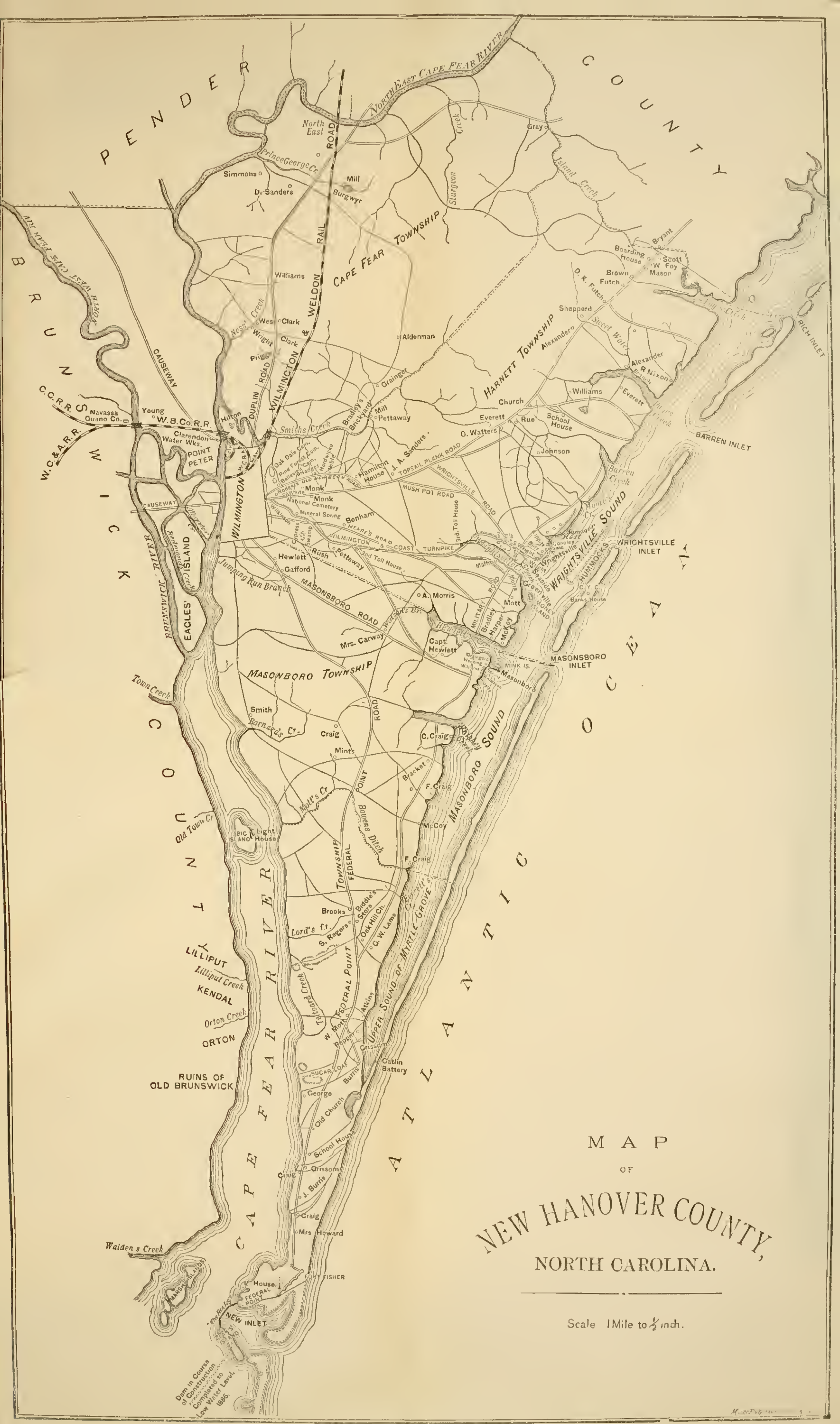


A path *b c* runs east and west as in the *figure*. I had set fire to the dry leaves in the drain and it was burning from *a* to *d*, about 75 yards, the flames often mounting up 10 feet. While this was going I rapidly spread fire along on the north side of the path from *a* to *b*, about 75 yards, so as to burn up the pine straw covering the ground up to the dotted line, say 20 feet. This fire spread to the north, its northern border (the blazing straw) maintaining its east and west direction, the wind blowing all the time from due east. After the blaze had got 6 or 8 feet from the path, and everything was going on to my satisfaction, I stopped at the path to look at it, when behold! there was a little tornado following the blaze from east to west whirling around from *left* to *right*. In two or three seconds it either lost its force or ascended out of reach of the blaze. Then there was another and another in rapid succession until I counted about thirty, and the straw was all consumed. They were developed so rapidly that I was unable to get a good view of one until it had moved a few feet, when the flame in its axis was rushing up above the normal height of the blaze.

Now for the conditions: The east wind, heated by the fire in the drain from *a* to *d*, did not blow along on or near the surface of the earth north of the burning pine straw, hence the air there was drawn towards the partial vacua south and east of it. Over the ground covered by the burnt pine straw, and bounded on the north, as well as I could judge, by the line of blazing straw, the east wind was blowing. Hence, as the cool air on the north rushed to the blaze and came in contact with the heated northern border of the east wind, the consequent check to its velocity on that side, produced the series of whirls from *left* to *right*.

B. F. GRADY.

Albertson's, N. C., August, 1886.


MAP
OF
NEW HANOVER COUNTY,
NORTH CAROLINA.
Scale 1 Mile to ½ inch.
PENDER COUNTY
BRUNSWICK COUNTY
ATLANTIC OCEAN
CAPE FEAR RIVER
NORTH EAST CAPE FEAR RIVER
NORTH WEST CAPE FEAR RIV
BRUNSWICK RIVER
WILMINGTON
EAGLES' ISLAND
POINT PETER
CAPE FEAR TOWNSHIP
HARNETT TOWNSHIP
MASONBORO TOWNSHIP
FEDERAL POINT TOWNSHIP
WILMINGTON & WELDON RAIL ROAD
W. B. Co. R. R.
W. C. & A. R. R.
C. C. R. R.
DUPLIN ROAD
TOPSAIL PLANK ROAD
MUSH POT ROAD
WRIGHTSVILLE ROAD
MASONSBORO ROAD
MILITARY ROAD
FEDERAL POINT ROAD
WILMINGTON & COAST TURNPIKE
CAUSEWAY
WRIGHTSVILLE SOUND
MASONBORO SOUND
UPPER SOUND OF MYRTLE GROVE
WRIGHTSVILLE INLET
MASONSBORO INLET
BARREN INLET
RICH INLET
NEW INLET
HUMMOCKS
FORT FISHER
SUGAR LOAF
RUINS OF OLD BRUNSWICK
ORTON
KENDAL
LILLIPUT
BIG ISLAND Light House
Town Creek
Old Town Cr.
Walden's Creek
Orton Creek
Lilliput Creek
Smiths Creek
Sturgeon Creek
Island Creek
Prince George Cr.
Jumping Run Branch
Barnard's Cr.
Mott's Cr.
Bowens Ditch
Dam in Course of Construction Completed to Low Water Level. 1886.

11,726
Jan 31. 1888

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